BUS TICKET RESERVATION SYSTEM

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Abstract

Electronic Commerce is one of the most important aspects of the Internet to emerge. It allows people to exchange goods and services immediately and with no barriers of time or distance. Any time of the day or night, people can go online and buy almost anything they want.

Puduraya Bus Ticket Agent (PBTA) System is an application based on the e-commerce technology. It makes use of client/server architecture to provide people with online access to bus companies' databases. The main purpose of PBTA is to offer more convenient way for people to get the ticket of bus companies that located in Puduraya.

There are 2 major modules in this application, which are user and administrator. User module enables people to acquire information and make a reservation of bus ticket. Administrator module provides extra facilities for the administrator to carry out housekeeping tasks and to maintain the database online.

It is strongly believed that emerging of PBTA System would make people life more comfortable and easier, as well as improving services of bus companies.

Acknowledgements

I would like to take this opportunity to express my gratitude to all those who have helped and guided me in this project. It is impossible to list here all those who helped to sustain me, and I apologize in advance for any omissions.

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Chapter 1 Introduction

This chapter gives an introduction about my thesis briefly. It explains the definition, objectives, scope and importance of the project. The project's schedule is shown before end up with the summary.

1.1 Project Definition:

The new Online Bus Ticket Booking System, called PUDURAYA BUS TICKET AGENT (PBTA), links the bus companies located in PUDURAYA electronically. The PBTA allows the public to make the reservation of bus ticket provided by bus companies in PUDURAYA through Internet using credit card. As the consequence, a lot of time can be saved and the public will feel more comfortable in buying the bus ticket. Nevertheless, the system also allows the buyers to change or cancel their reservation, but a fixed penalty is charged depending on the day the change or cancellation is made. The system also provides a search engine for users to acquire information such as the available bus line and schedule of the buses.

With the existence of PBTA, the bus companies can expand their service without being restricted by distance, e.g. someone can buy a ticket that departs from Johor Bharu from anywhere. Moreover, the system provides the service 24 hours a day. This will definitely increase the companies' profit and make their service more users friendly and more convenient to be achieved by public.

1.2 Project Motivation:

Nowadays many people feel inconvenient in buying the tickets from PUDURAYA because the counters of the bus companies are scattered and disordered. For example, there are many bus companies that provide the travel line from Kuala Lumpur to Muar. So if someone intends to buy a ticket, he will need to loiter from one

counter to another counter in order to find out the schedule of the buses. After that, he will need to queue at the company's counter to buy the ticket. But if, unfortunately, the ticket he needs is already sold out, then he is forced to try at another counter by queue up again. Besides that, people also face problem in acquiring the information because most companies' receptionist and seller is the same person. Furthermore, there are some people used to park their cars on the roadside and go to buy the ticket. This has caused the more heavy traffic in PUDURAYA especially on the public holidays.

The problems have been pointed out above become the motivations of PUDURAYA BUS TICKET AGENT to be developed. It is intended to solve those problems by provided the free service to the public so as there is another choice available for buying the long-distance bus tickets.

1.3 Project Objectives:

The PBTA System is proposed to cater for the needs of people. Besides, it is necessary to modify current approach of bus companies to conduct their services. The PBTA System is to achieve the following objectives:

i. Provide the online service for buying bus ticket and acquiring information.
ii. Help to reduce the problem of traffic jam in PUDURAYA.
iii. Help to improve the service provided by the bus companies.

1.4 Project Scopes

The project scopes refer to the extent to which it is possible to range the project. It also defines the limitations of the system. The scopes of PBTA are stated as below:

i. Develop a web-based application that can be accessed by all the Internet users.
ii. Establish a stable connection or link between the system server and the bus companies' database.
iii. Automate the process for purchasing bus ticket.

v. Provides online information acquiring service.
vi. Develop the database for keeping members' information and existing reservations, so as the cancellation or change can be made.
vii. The security issues are not taken under the consideration for this project.
viii. The services are constrained by those bus companies that don't possess their own database system yet.

1.5 Project Importance

i. Enhance bus companies' business with e-commerce technologies.
ii. Help to avoid bus companies being left behind by other sectors that have been fully applied information technology.
iii. Encourage the using of information technology among public services.

1.6 Project Schedule

Figure 1.1 shows the project schedule that used for developing and implementing the system.

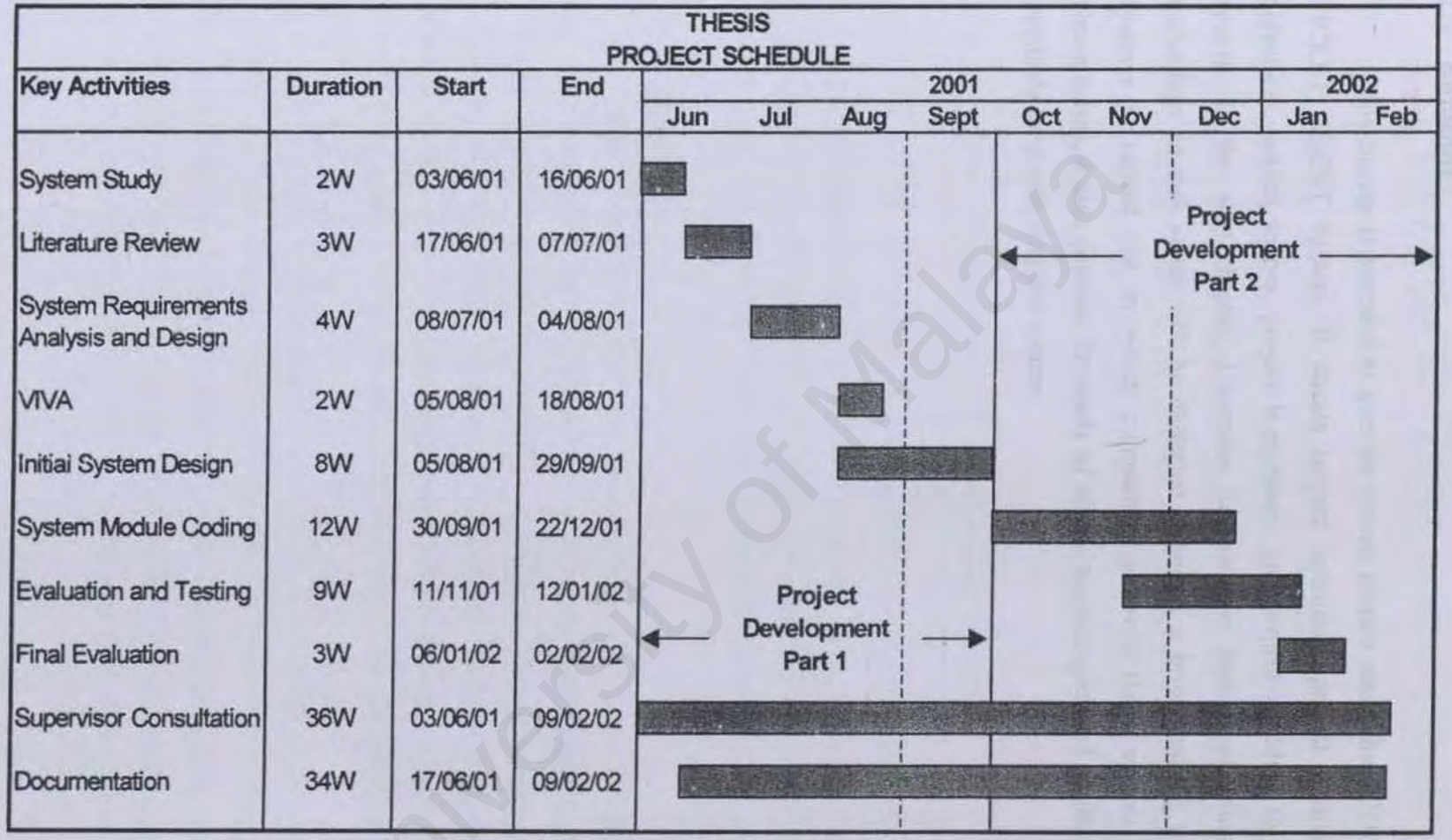


Figure 1.1 Project schedule for PBTA System.

1.7 Summary

This chapter is intended to give the overall picture about the PUDURAYA BUS TICKET AGENT System. It covers project definition, project motivation, project objectives, project scopes, project importance, and project schedule to complete the system. In the next chapter, Literature Review, the history of using information technology in this sector will be dissected. Besides, a brief analysis to the existing systems is carried out in which comparison between those systems is included. Nevertheless, it also contains the study of all the technologies and applications that are available for developing this system.

Chapter 2 Literature Review

Before the development of PUDURAYA BUS TICKET AGENT System is carried out, literature survey has been conducted to grasp a better understanding of various aspects involved with this project. The survey areas included electronic commerce, security issues of the Internet, web languages, web technologies, operating system platform, databases and existing systems. The chapter ended up with summary of the important information that should be paid attention.

2.1 Electronic Commerce and the Security Issues

One of the most popular Internet myths claims that building an online store is easy: All the customer has to do is point, click, and buy! But in reality, successful e-commerce is far more complex and unlike any other website project that may have tackled in the past. As the result, it is needed to do considerable research and planning.

2.1.1 Introduction

Today's Internet consumer can log on and place orders for merchandise, tickets, and other goods. As telephone customer services become overwhelmed, more and more companies are turning to the Internet to provide the consumer another means of transacting business more expediently. Companies use e-commerce to develop competitive advantages by providing more useful information, expanding choice, developing new services, streamlining purchasing processes, and lowering costs.

However many businesses and consumers are still wary of conducting extensive business over the Internet because of the lack of a predictable legal environment governing transactions. This is particularly true for international commercial activity where concerns about enforcement of contracts, liability, intellectual property protection, privacy, security and other matters have caused businesses and consumers to be cautious.

2.1.2 Security Issues

E-commerce is a powerful tool for business transformation that allows companies to enhance their supply-chain operation, reach new markets, and improve services for customers as well as for suppliers and employees. However implementing the e-commerce applications that provide these benefits may be impossible without a coherent, consistent approach to e-commerce security. If Internet users do not have confidence that their communications and data are safe from unauthorized access or modification, they will be unlikely to use the Internet on a routine basis for commerce. A secure e-commerce requires:

- secure and reliable telecommunications networks
- effective means for protecting the information systems attached to those networks
- effective means for authenticating and ensuring confidentiality of electronic information to protect data from unauthorized use
- well trained e-commerce users who understand how to protect their systems and their data

Traditional network security has focused solely on keeping intruders out using tools such as firewalls. This is no longer adequate. E-commerce means letting business partners and customers into the network, essentially through the firewall, but in a selective and controlled way, so that they access only the applications they need. Accomplishing that goal requires a range of technologies (encryption, authentication, password controls, firewalls, etc.) and effective, consistent use of those technologies; all supported globally by trustworthy key and security management infrastructures. Of particular importance is the development of trusted certification services that support the digital signatures that will permit users to know whom they are communicating with on the Internet. Both signatures and confidentiality rely on the use of cryptographic keys.

To date, organizations have controlled and managed access to resources by building authorization and authentication into each e-commerce application. This

between the browser and the server unencrypted. Because of these fears, methods are being developed to make purchasing products online more secure.

The first attempt at making online credit card transactions secure was to take the transaction off-line. Many sites will allow buyers to call in their credit card number to a customer support person. This solves the problem of passing the credit card number over the Internet, but eliminates the merchant's ability to automate the purchasing process. An employee needs to be available 24 hours a day to take phone calls from buyers. Also, many potential customers that visit the net only have one phone line. This means they need to log off the Internet in order to actually make a purchase.

The next method that was developed, which is currently used by many sites, is hosting the WWW site on a secure server. A secure server is one that uses a protocol such as SSL or S-HTTP to transmit data between the browser and the server. These protocols encrypt the data being transmitted, so when customer submit his or her credit card number through their WWW form it travels to the server encrypted. This method does help ease people's fear, but it still does not go far enough for many people to feel comfortable using their credit card online.

It was apparent that for online commerce to flourish, a truly secure means of making payment needed to be developed. The following section describes three systems for secure credit card transactions online, which should meet this need.

2.1.3.2 First Virtual Holdings

First Virtual was one of the first Internet payment systems to be available to the public, becoming fully operational in October of 1994. A main goal of this company was to create an Internet payment system that was easy to use. Neither buyers nor sellers are required to install new software, (though automated sale processing software is available). Anyone who has Internet email account can sell or buy over the Internet using the First Virtual System.

The First Virtual payment system is unique in that it does not use encryption. A fundamental philosophy of their payment system is that certain information should not travel over the Internet because it is an open network. This includes credit card numbers. Instead of using credit card numbers, transactions are done using a First VirtualPIN, which references the buyer's First Virtual account. These PIN numbers can be sent over the Internet because even if they are intercepted, they cannot be used to charge purchases to the buyer's account. A person's account is never charged without email verification from them accepting the charge.

Their payment system is based on existing Internet protocols, with the backbone of the system designed around Internet email and the MIME (Multipurpose Internet Mail Extensions) standard. First Virtual uses email to communicate with a buyer to confirm charges against their account. Sellers use either e-mail, Telnet, or automated programs that make use of First Virtual's Simple MIME Exchange Protocol (SMXP) to verify accounts and initiate payment transactions.

The First Virtual payment system has several advantages and disadvantages over other payment systems used on the Internet.

Advantages:

- Neither buyer nor seller needs to install any software in order to use the system.
- Buyers are virtually 100% protected from fraud. No charges are processed against their account without their confirmation.
- Purchases are essentially anonymous. The merchant is never given the buyer's name from First Virtual.
- It is extremely easy to become a merchant, or seller, under First Virtual. First Virtual does not screen merchants, nor do they require merchants to have a special business accounts established with a bank. All a person needs to sell merchandise, services, data, etc. over the Internet is an ordinary checking account.
- First Virtual has very low processing fees compared to other Internet payment schemes or even straight credit card processing.

Disadvantages:

- Merchant assumes all risk!
- Extremely long waiting period between when a sale is made and when payment is deposited in the merchant's account.

2.1.3.3 CyberCash

CyberCash has been servicing credit card transactions over the Internet since April 1995. It has strong ties to the current credit card processing infrastructure, through Bill Melton, a founder of Verifone, as one of its fathers. The use of their payment system has grown tremendously over a year. CyberCash claims that they process thousands of transactions a day, they can send payment transactions to 80% of the banks in America, and to have distributed over 400,000 copies of CyberCash Wallet software to buyers who use their system.

It is important to note that CyberCash is not a credit card processing company. Unlike First Virtual, they do not transfer funds into the merchant's account. CyberCash sells safe passage over the Internet for credit card transaction data. They take the data that is sent to them from the merchant, and pass it to the merchant's acquiring bank for processing. Except for dealing with the merchant through CyberCash's server, the acquiring bank processes the credit card transaction as they would process transactions received through a point of sale (POS) terminal in a retail store.

The CyberCash payment system is centered to the CyberCash Wallet software program, which buyers use when making a purchase. This program must be downloaded and installed on the buyer's machine before they can make a purchase. This program handles passing payment information, encrypted, between the buyer and the merchant.

Once a potential buyer has obtained the CyberCash Wallet and installed it, there are still a few steps to take before it can be used. First, a buyer needs to create a personal or wallet ID, which is a string of characters that identify the wallet, and a password. These are then registered with CyberCash. Buyers are allowed to create more than one

wallet ID, each with its own password. Secondly, they must bind at least one credit card to the wallet. Binding a credit card entails entering pertinent credit card processing information such as credit card number, expiration date, shipping address and phone number. This information is then registered with CyberCash. Buyers can bind multiple credit cards to the wallet. Once the wallet ID is established, and at least one card has been bound, the buyer is ready to start purchasing.

To be able to accept payment using the CyberCash system, merchants must do two things. First, the merchants must install the CyberCash Internet Payment Software (SMPS). This software allows the merchant to interface with both the CyberCash buyer, or Wallet software, and CyberCash's servers. Secondly, the merchant must establish a merchant account with an acquiring bank that supports Internet transactions using CyberCash's Secure Internet Payment System. CyberCash can only communicate with banks they have an agreement with them.

As with First Virtual, the CyberCash system has its own set of advantages and disadvantages.

Advantages:

- CyberCash uses strong encryption for transporting payment information.
- The Merchant does not see the buyer's credit card number.
- Merchants do not have a waiting period for receiving payment, as with First Virtual. The merchant's bank account is credited within in the normal time frame for credit card transactions.

Disadvantages:

- Potential buyers and merchants must both install extra software in order to use the system. This makes the system harder to use for people with little computer experience.
- Merchants need to have an account with an acquiring bank that accepts CyberCash Secure Internet Payments.

2.1.3.4 SET (MasterCard/Visa)

SET stands for Secure Electronic Transactions and is a proposed standard for performing credit card transactions over the Internet. It is developed jointly by Visa and MasterCard, with technical assistance from various Internet, information systems, and cryptology companies such as Netscape, IBM and VeriSign. With these names behind it, in the future SET may very well become the dominant method for paying by credit card over the Internet.

MasterCard and Visa are developing SET as a license-free protocol for credit card transactions over the Internet. Even though it is being developed by MasterCard and Visa, the protocol can be used by any type of credit card such as American Express or Discover.

There are several goals they want to achieve by creating this protocol. First, they want to create a simple, inexpensive way for merchants to conduct credit card sales over the Internet. Second, they want to produce a protocol for processing credit card transactions that would have little impact on the existing financial infrastructure. Third, the SET protocol will allow software vendors to produce credit card payment software that will interoperate. Also, by being an open, license-free standard, SET will create a level playing field and insure competition among software vendors. This should keep costs down for merchants and financial institutions interested in processing credit card payments over the Internet.

On the surface, the SET protocol looks very similar to the CyberCash payment system. Merchants and buyers will both need software, which follows the SET protocol in order to use SET for credit card transactions. Also, acquiring banks process credit card transaction requests delivered to them through SET in much the same way as the process requests coming through a point of sale terminal. Merchants can request the same type of transactions (authorize, authorize and capture, etc.) as they can through CyberCash.

There are differences between CyberCash and SET. CyberCash takes an active role in processing each credit card transaction that flows through their system.

CyberCash's server sits in between the merchant and the acquiring bank. It verifies the identity of the buyer and the merchant involved in the transaction. The server also handles the translation from a CyberCash format for transaction data to the format used by the acquiring banks. With SET, there is no single company which will be responsible for processing the transactions. The task of translation from SET request format to the format used by acquiring banks is done by the SET payment gateway. These gateways will either running by companies contracted by the acquiring banks to do so on their behalf (most likely), or by the acquiring banks themselves. Identity verification of buyers, merchants, and acquiring banks is not handled by a centralized server. SET uses a system of certificates for party verification. Certificates are issued by a trusted entity or "certificate authority" that can vouch that the parties presenting a digital signature are who they say they are. The certificate shows that the signature has been proven to belong to the party in question. These certificates are passed between the buyer's, merchant's, and acquirer's payment gateway software to prove that each entity involved in the transaction is who they claim to be.

The SET protocol provides the following advantages and disadvantages over other payment systems:

Advantages:

- Eliminates the need for a third party to monitor Internet credit card transactions. This will lower the cost of doing credit card business over the Internet.
- Strong encryption and authentication scheme to be used.
- Merchant does not have access to the buyer's credit card number.
- Merchants do not have a waiting period for receiving payment, as with First Virtual. The merchant's bank account gets credited within in the usual time frame for credit card transactions.
- Is backed by MasterCard and Visa.

Disadvantages:

- Buyers and merchants will need to install software, which allows SET transactions processing. Acquiring banks will either need to contract with a company to run a SET Internet gateway for them, or install a SET Internet gateway themselves.
- Merchants will need to have an account with an acquiring bank or card processor that is set up to accept SET transactions.

2.2 Web Languages and Technologies

2.2.1 World Wide Web (WWW)

World Wide Web refers to an Internet facility that links documents locally and remotely. The Web document, or Web page, contains text, graphics, animations, audios and videos as well as hypertext links. The links in the page let users jump from page to page (hypertext) whether the pages are stored on the same server or on servers around the world. Web pages are accessed and read via a Web browser, the two most popular being Internet Explorer and Netscape Navigator.

The Web has also turned into an online shopping mall as almost every organization has added electronic commerce (e-commerce) capabilities. In addition, the Web has become a multimedia delivery system as new browser features and plug-in extensions allow for audio, video, telephony, 3-D animations and videoconferencing. Most browsers also support the Java language, which allows applications to be downloaded from the Net and run locally.

The fundamental Web format is a text document embedded with HTML (Hypertext Markup Language) tags that provide the formatting of the page as well as the hypertext links (URLs) to other pages. HTML codes are common alphanumeric characters that can be typed with any text editor or word processor. Numerous Web publishing programs provide a graphical interface for Web page creation and automatically generate the HTML codes. Many word processors and publishing programs

also export their documents to HTML, thus basics Web pages can be created by users without learning any coding system. The ease of page creation has helped fuel the Web's growth.

Large organizations create their own Web sites, but the actual Web servers (computer systems) that store the Web pages are often housed (co-located) at third party facilities that provide space, power and access to the Internet. Smaller Web sites are generally hosted on servers run by their Internet Service Providers (ISPs). Countless individuals have developed personal Web pages as many ISPs include this service with their monthly access charge. Individuals can post their resumes, hobbies and whatever else they want as a way of introducing themselves to the world at large.

2.2.2 Internet

The Internet is a gigantic collection of millions of computers, all linked together on a computer network. The network allows all of the computers to communicate with one another. A home computer is usually linked to the Internet using a normal phone line and a modem that talks to an Internet Service Provider (ISP). A computer in a business or university has a Network Interface Card (NIC) that directly connects it to a Local Area Network (LAN) inside the business. The business then connects its LAN to an ISP using a higher speed phone line like a T1 line. A T1 line can handle approximately 1.5 million bits per second, while a normal phone line using a modem can usually handle 30,000 to 50,000 bits per second.

ISPs then connect to larger ISPs, and the largest ISPs maintain fiber-optic "backbones" for an entire nation or region. Backbones around the world are connected through fiber optic lines, undersea cables or satellite links. In this way, every computer on the Internet is connected to every other computer on the Internet.

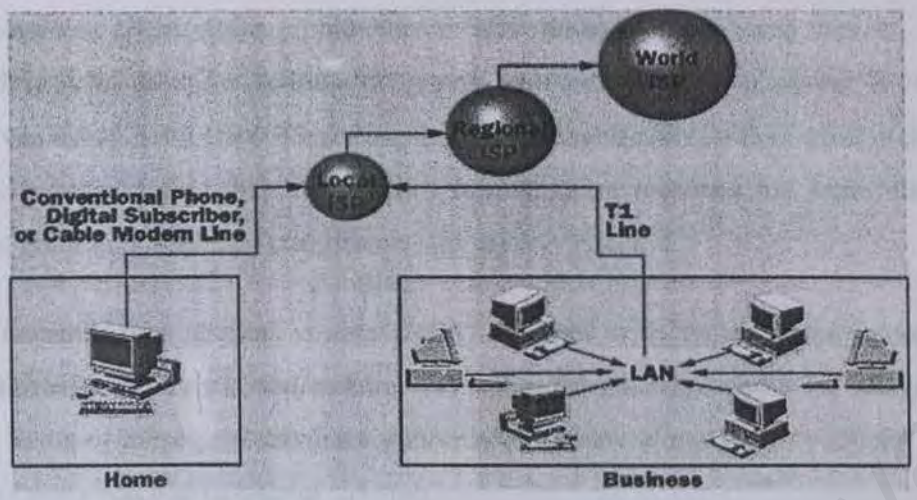


Figure 2.1 The Internet backbone and connection.

2.2.3 Clients and Servers

In general, all of the machines on the Internet can be categorized as two types: servers and clients. Those machines that provide services (like Web servers or FTP servers) to other machines are servers. And the machines that are used to connect to those services are clients. Since the early 1990s, client/server has been the buzzword for building applications on LANs in contrast to centralized minicomputer and mainframes with dedicated terminals.

The client contains the user interface and may perform some or all of the application processing. Servers can be high-speed microcomputers, minicomputers or even mainframes. A database server maintains the databases and processes requests from the client to extract data from or update the database. An application server provides additional business processing for the clients.

The term client/server is sometimes used to contrast a peer-to-peer network, in which any client can also act as a server. In that case, client/server means nothing more than having a dedicated server.

However, client/server architecture means more than dedicated servers. Simply downloading files from or sharing programs and databases on a server is not true client/server either. True client/server implies that the application was originally designed to run on a network and that the network infrastructure provides the same quality of service as traditional mini and mainframe information systems.

The network operating system (NOS) together with the database management system (DBMS) and transaction monitor (TP monitor) are responsible for integrity and security. Some of these products have gone through many client/server versions by now and have finally reached industrial strength.

2.2.3.1 Non-Client/Server

In non-client/server architecture, the server is nothing more than a remote disk drive. The user's machine does all the processing. If many users routinely perform lengthy searches, this can bog down the network, because each client has to pass the entire database over the net. At 1,000 bytes per record, a 10,000 record database requires 10MB of data be transmitted.

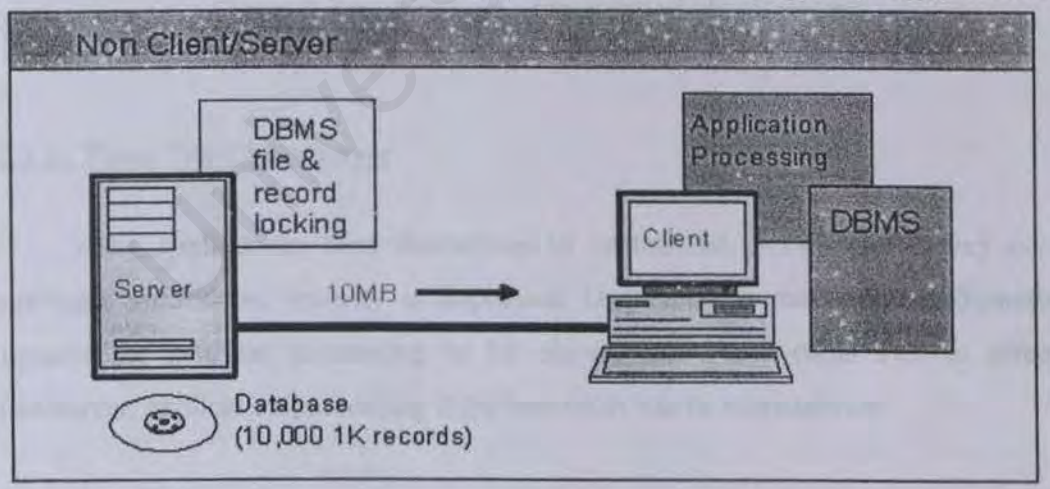


Figure 2.2 Architecture of Non-client/server.

2.2.3.2 Two-Tier Client/Server

Two-tier client/server is really the foundation of client/server. The database processing is done in the server. An SQL request is generated in the client and transmitted to the server. The DBMS searches locally and returns only matching records. If 50 records met the criteria, only 50K would be transmitted. This reduces traffic in the LAN.

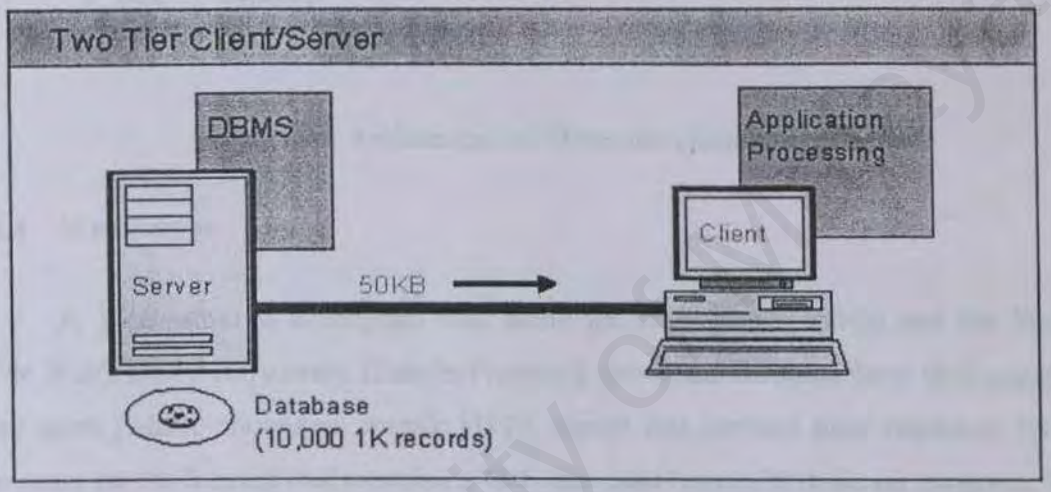


Figure 2.3 Architecture of foundation client/server.

2.2.3.3 Three-Tier Client/Server

Many applications lend themselves to centralized processing. If they contain proprietary algorithms, security is improved. Upgrading is also simpler. Sometimes, programs are just too demanding to be placed into every client PC. In three-tier client/server, application processing is performed in one or more servers.

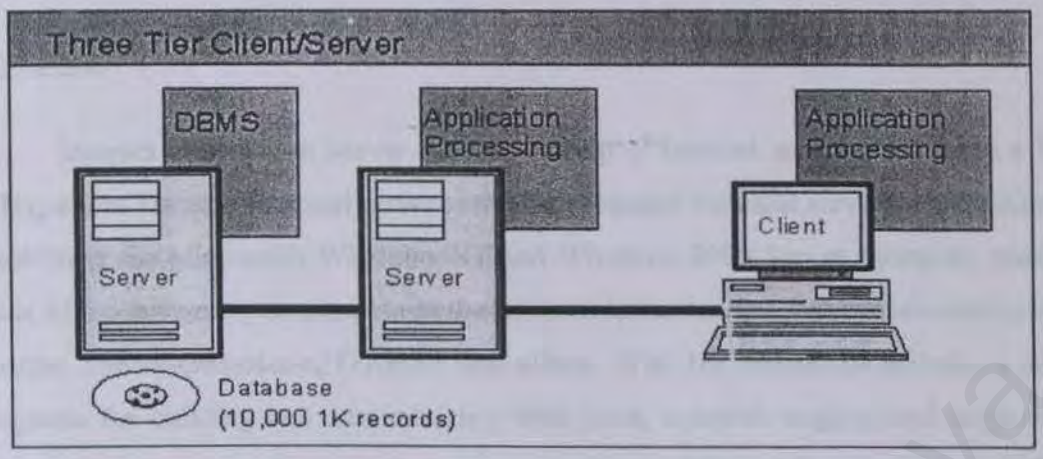


Figure 2.4 Architecture of Three-tier client/server.

2.2.4 Web Server

A Web server is a program that, using the client/server model and the World Wide Web's HTTP (Hypertext Transfer Protocol), serves the files that form Web pages to Web users (whose computers contain HTTP clients that forward their requests). Every computer on the Internet that contains a Web site must have a Web server program. The most popular Web servers are Microsoft's Internet Information Server (Internet Information Server), which comes with the Windows NT Server or Windows 2000 Server; Netscape FastTrack and Enterprise servers; and Apache, a Web server for UNIX-based operating systems. Other Web servers include Novell's Web Server for users of its NetWare operating system and IBM's family of Lotus Domino servers, primarily for IBM's OS/390 and AS/400 customers.

Web servers often come as part of a larger package of Internet- and intranet-related programs for serving e-mail, downloading requests for File Transfer Protocol files, and building and publishing Web pages. Considerations in choosing a Web server include how well it works with the operating system and other servers, its ability to handle server-side programming, and publishing, search engine, and site building tools that may come with it.

2.2.4.1 IIS

Internet Information Server (IIS) is a group of Internet servers (including a Web or Hypertext Transfer Protocol server and a File Transfer Protocol server) with additional capabilities for Microsoft's Windows NT and Windows 2000 Server operating systems. IIS is Microsoft's entry to compete in the Internet server market that is also addressed by Apache, Sun Microsystems, O'Reilly, and others. With IIS, Microsoft includes a set of programs for building and administering Web sites, a search engine, and support for writing Web-based applications that access databases. Microsoft points out that IIS is tightly integrated with the Windows NT and 2000 Servers in a number of ways, resulting in faster Web page serving.

A typical company that buys IIS can create pages for Web sites using Microsoft's Front Page product (with its WYSIWYG user interface). Web developers can use Microsoft's Active Server Page (ASP) technology, which means that applications - including ActiveX controls - can be imbedded in Web pages that modify the content sent back to users. Developers can also write programs that filter requests and get the correct Web pages for different users by using Microsoft's Internet Server Application Program Interface (ISAPI). ASP and ISAPI programs run more efficiently than common gateway interface (CGI) and server-side include (SSI) programs, two current technologies. (However, there are comparable interfaces on other platforms.)

Microsoft includes special capabilities for server administrators designed to appeal to Internet service providers (ISPs). It includes a single window (or "console") from which all services and users can be administered. It's designed to be easy to add components as snap-ins that you didn't initially install. The administrative windows can be customized for accessed by individual customers.

IIS includes security features and promises that it is easy to install. It works closely with the Microsoft Transaction Server to access databases and provide control at

the transaction level. It also works with Microsoft's Netshow in the delivery of streaming audio and video, delayed or live.

2.2.4.2 PWS

PWS, an abbreviation for Personal Web Server, is Microsoft's version of a Web server program for individual PC users who want to share Web pages and other files from their hard drive. PWS is a scaled-down version of Microsoft's more robust Web server, Internet Information Server IIS. PWS can be used with a full-time Internet connection to serve Web pages for a Web site with limited traffic. It can also be used for testing a Web site offline or from a "staging" site before putting it on a main Web site that is exposed to larger traffic.

PWS can be used together with Microsoft's FrontPage, a Web site design product, to upload Web pages from a remote location or to the local hard drive; to check for dead links; to create directories; and to set permissions. PWS is frequently used as part of the trend toward peer-to-peer exchange and publishing.

The equivalent program for the Macintosh is called Personal Web Sharing.

2.2.4.3 CERN Server

CERN Server created by the European High Energy Physics Lab Group. It was the first Web server - the starting point for the World Wide Web. It still is the test site for many of the experimental features being tried each day. Even though the CERN Web server is no longer the most popular server on the Net, it has one feature that cannot get anywhere else right now. If trying to create a really secure site and want to use a Web server as the proxy host, the CERN server is the way to go.

The CERN server enables the implementation of a firewall to protect network from intruders while still allowing Internet WWW access from inside the firewall. Firewalls are great security barriers for preventing unwanted guests from getting into the secure network. A firewall typically works by allowing only a select set of trusted

machines access to the network. A machine called a *proxy* is used to screen incoming and outgoing connections.

2.2.4.4 Netscape Enterprise Server

Netscape Enterprise Server is high-performance, highly scalable web server software for deploying the largest-scale web sites. Netscape Enterprise Server was voted Best of 1998 by PC Magazine and is running some of the largest e-commerce, ISP, and portal web sites on the Internet, including E-Commerce, Schwab, Digex, Excite, and Lycos.

By providing such capabilities as fail over, automatic recovery, and dynamic log rotation as well as high performance and scalability for dynamic and secure content, Enterprise Server extends Netscape's commanding lead in the web server software market. According to GartnerGroup's October 1998 survey of web server usage on public web sites, Netscape software runs 43.8 percent of these sites, compared to Microsoft IIS at 20.5 percent and Apache at 22 percent. In addition, the survey also shows that Enterprise Server software runs 66.8 percent of Fortune 100 public sites, compared to Microsoft IIS at 16.8 percent and Apache at 9.4 percent.

2.2.5 Web Application Development Technologies

2.2.5.1 ASP

ASP is:

i. an abbreviation for Active Server Pages
ii. Free and already built into Windows 2000. It is part of IIS and must be added with add/remove programs menu.
iii. Free for NT4 or Windows 95/98 if one installs the NT4 Option Pack. It can be downloaded from

http://www.microsoft.com/ntserver/nts/downloads/recommended/NT4OptPk/default.asp

Since ASP can be installed on Windows 95/98 computers to test ASP scripts, thus the NT Option Pack4 has a very misleading name in which it installs in Windows 9x as well.

iv. The code inside ASP is mixed in with standard HTML and is never seen by the browser. ASP pages run in all browsers unless the person making the page uses HTML or browser commands outside of the ASP portions.

2.2.5.2 CGI

CGI programming is writing the programs that receive and translate data sent via the Internet to your WWW server. It is using for translated data and understanding how to send valid HTTP response headers and HTML tags back to your WWW client. There are absolutely no restrictions on what CGI program can be. The only limitation on a CGI program is the requirement that it must understand the HTTP request/response headers and that it usually will be dealing with HTML in some manner. A plain HTML document that the Web server delivers is static, which means it doesn't change. A CGI program, on the other hand, is executed in real-time, so that it can output dynamic information - perhaps a weather reading, current system time, or the latest results from a database query. CGI allows someone visiting your Web site to run a program on your machine that performs a specified task. Frequently, CGI applications are small, quickly built programs that perform some simple task. As the Web grows more sophisticated, however, CGI applications will become larger and more complex.

2.2.5.3 JSP

Java Server Page (JSP) is a technology for controlling the content or appearance of Web pages through the use of servlet, small programs that are specified in the Web page and run on the Web server to modify the Web page before it is sent to the user who requested it. Sun Microsystems, the developer of Java, also refers to the JSP technology as the Servlet application program interface (API). JSP is comparable to Microsoft's Active Server Page (ASP) technology. Whereas a Java Server Page calls a Java program that is executed by the Web server, an Active Server Page contains a script that is

interpreted by a script interpreter (such as VBScript or JScript) before the page is sent to the user.

2.2.5.4 Cold Fusion

Allaire's Cold Fusion continues to be the hottest ticket item to hit the web. Behind the scenes, Cold Fusion is like a robot. It is given a set of instructions to interchange data with a database and automatically construct an HTML page that can be interpreted by a web browser such as Internet Explorer or Netscape. To accommodate end-users who wish to make changes to the database, Cold Fusion can be given instructions to generate a data entry page. Cold Fusion supports various databases format such as Microsoft Access, Sybase and Oracle, which run on various platforms such as Novell, UNIX, and 3270 mainframe computers. This way, a business can interface their existing data with web sites. It can be simply done with interfaces called ODBC or "open database connectivity" drivers. These drivers are translators between one database formats to another. A Cold Fusion system administrator's tool establishes the ODBC bridging by means of establishing a "data source."

Cold Fusion is a tool that enables programmers to develop web-based applications that access databases. Cold Fusion or CF is a set of 'extended' HTML tags known as CFML - Cold Fusion Markup Language. Programming in CFML is as easy as programming in HTML. Each CFML tag has a beginning such as and an ending tag just like HTML. CFML and HTML tags are used in the same file. CFML files are given the extension of CFM instead of HTM/HTML and are called templates. This allows the web server to execute the template and create the corresponding HTML code that is returned to the client browser.

The way CF works relative to the client Browser is very straightforward. The client browser makes a request for a CFM template the same way it makes a request for any HTM page, by calling that page.

The server loads the CFM page and executes any CF tags and generates the appropriate HTML code. If there is a call to a database, CF accesses the database and performs the action requested, such as retrieving data, updating fields, inserting new records or deleting records. The client browser displays the resulting HTML code as it does any HTML code.

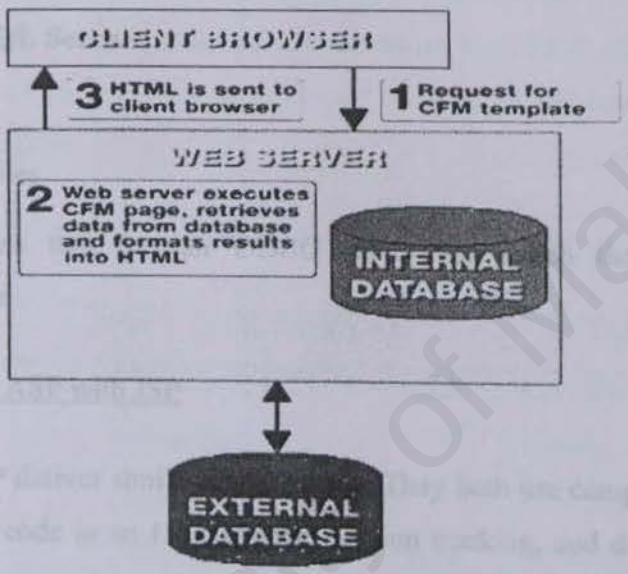


Figure 2.5 Basic architecture of web-based application through Cold Fusion.

CF system requirements are:

- Windows NT 3.51 or higher or Windows 95.
- 486 CPU or higher with a Pentium preferred.
- 30 MB of free disk space.
- 24 MB or RAM with 32 MB preferred.
- A web browser.
- A CD ROM to install the software.

Databases that CF can access:

- Borland **dBase** III and dBase IV
- Borland **Paradox** 3.X and 4.x
- Microsoft **Access** 1.0, 2.0 and 7.0
- Microsoft **Excel** 3.0, 4.0 and 5.0
- Microsoft **Fox Pro** 2.0, 2.5 and 2.6
- Microsoft **SQL Server**
- **Oracle** 7.X
- Plain Text Files
- Any database that has an ODBC driver for which the web server can communicate

2.2.5.5 Comparing ASP with JSP

ASP and JSP deliver similar functionality. They both use component objects, tags to allow embedded code in an HTML page, session tracking, and database interaction. ASP uses ActiveX components, while JSP uses JavaBeans as the component architecture.

Both also have their strengths and weaknesses. One edge ASP seemingly has over JSP is a gentler learning curve. A developer's first exposure to ASP will most likely be through Microsoft Visual Interdev, a polished and approachable GUI tool. A developer's first exposure to JSP, however, will probably be through one of Sun's development kits, which, although strong tools for the purpose they serve, are primarily command line-based.

Further adding to the learning curve of JSP is Java's underlying object-oriented nature. While the fact that Java is object-oriented is largely responsible for the power of the language, it also raises the level of its complexity. Put it this way: a smart eighth grader who knows a little basic and a little HTML can be taught to program ASP in one or two days. With JSP, this just isn't going to happen.

While JSP might have a steeper learning curve, it also has a much higher ceiling; it would take a longer time to run into something that can't do using ASP. Java as a language is more powerful than the VBScript model of ASP. A major difference that needs to be mentioned is an advanced feature of JSP known as extensible tags. Through this mechanism, a user can create custom tags - essentially allowing anyone to extend the JSP tag language. This is something that can't do with ASP.

ASP can run only on machines running IIS - and therefore only on Windows NT or Windows 2000. So, it does require a commitment to Microsoft. JSP doesn't tie to any particular Web server or operating system and, outside of Microsoft, is becoming a widely supported standard.

Table 2.1 A detailed comparison between ASP technology and JSP technology.

	ASP Technology	**JSP** Technology
Web Server	Microsoft **IIS** or **Personal Web Server**	**Any** Web server, including **Apache**, **Netscape**, and **IIS**
Platforms	**Microsoft** Windows (Accessing other platforms requires third-party ASP porting products)	Most popular platforms, including the **Solaris** Operating Environment, **Microsoft** Windows, **Mac** OS, **Linux**, and other **UNIX** platform implementations
Reusable, Cross-Platform Components	No	JavaBeans, Enterprise JavaBeans, custom JSP tags
Security Against System Crashes	No	Yes
Memory Leak Protection	No	Yes
Scripting Language	VBScript, Jscript	Java
Customizable Tags	No	Yes
Compatible with Legacy Databases	Yes (COM)	Yes (using JDBC API)

Ability to Integrate with Data Sources	Works with any ODBC-compliant database	Works with any ODBC- and JDBC technology-compliant database
Components	COM components	JavaBeans, Enterprise JavaBeans, or extensible JSP tags
Extensive Tool Support	Yes	Yes

2.2.6 Programming/Scripting Languages

2.2.6.1 XML

Just as HTML lets developers describe the format of a Web document, Extensible Markup Language (XML) lets them describe complex data structures. Developers can share this information across a variety of applications, clients, and servers. Using the new Microsoft XML Parser, developers can create applications that enable their Web server to exchange XML-formatted data with both Microsoft Internet Explorer and any server capable of parsing XML.

2.2.6.2 HTML

HTML (Hypertext Markup Language) is designed primarily for formatting text. It is basically a typesetting language that specifies the shape of the text, the color, where to put it, and how large to make it. It's not much different from most other typesetting languages, except that it doesn't have as many typesetting options as most simple *What You See Is What You Get* (WYSIWYG) editors, such as Microsoft Word.

HTML is the set of markup symbols or codes inserted in a file intended for display on a World Wide Web browser page. The markup tells the Web browser how to display a Web page's words and images for the user. Each individual markup code is

referred to as an element (but many people also refer to it as a tag). Some elements come in pairs that indicate when some display effect is to begin and when it is to end.

HTML is a formal Recommendation by the World Wide Web Consortium (W3C) and is generally adhered to by the major browsers, Microsoft's Internet Explorer and Netscape's Navigator, which also provide some additional non-standard codes. The current version of HTML is HTML 4.0. However, both Internet Explorer and Netscape implement some features differently and provide non-standard extensions. Web developers using the more advanced features of HTML 4 may have to design pages for both browsers and send out the appropriate version to a user. Significant features in HTML 4 are sometimes described in general as dynamic HTML. What is sometimes referred to as HTML 5 is an extensible form of HTML called Extensible Hypertext Markup Language (XHTML).

2.2.6.3 JavaScript

JavaScript is an interpreted programming or script language from Netscape. It is somewhat similar in capability to Microsoft's Visual Basic, Sun's Tool Command Language, the UNIX-derived Practical Extraction and Reporting Language, and IBM's Restructured Extended Executor. In general, script languages are easier and faster to code in than the more structured and compiler languages such as C and C++. Script languages generally take longer to process than compiled languages, but are very useful for shorter programs.

JavaScript is used in Web site development to do such things as:

- Automatically change a formatted date on a Web page
- Cause a linked-to page to appear in a popup window
- Cause text or a graphic image to change during a "mouse rollover"

JavaScript uses some of the same ideas found in Java, the compiled object-oriented programming language derived from C++. JavaScript code can be imbedded in HTML pages and interpreted by the Web browser (or client). JavaScript can also be run

at the server as in Microsoft's Active Server Pages (Active Server Page) before the page is sent to the requestor. Both Microsoft and Netscape browsers support JavaScript, but sometimes in slightly different ways.

2.2.6.4 VBScript

VBScript is an interpreted script language from Microsoft that is a subset of its Visual Basic programming language. VBScript can be compared to other script languages designed for the Web, including:

- Netscape's JavaScript
- Sun Microsystem's Tool Command Language
- The UNIX-derived Practical Extraction and Reporting Language
- IBM's Restructured Extended Executor

VBScript is Microsoft's answer to Netscape's popular JavaScript. Both are designed to work with an interpreter that comes with a Web browser - that is, at the user or client end of the Web client/server session. VBScript is designed for use with Microsoft's Internet Explorer browser together with other programming that can be run at the client, including ActiveX control, automation servers, and Java applet. Although Microsoft does support Netscape's JavaScript (it converts it into its own JScript), Netscape does not support VBScript. For this reason, VBScript is best used for intranet Web sites that use the Internet Explorer browser only.

2.2.7 Web Browsers

2.2.7.1 Opera 4.0

The good: Loads Web pages quickly, includes an email client and a cookie manager to keep track of information stored by Web sites.

The bad: Costs $30; lacks features that come standard in other browsers, such as support for Java and ActiveX Controls.

The previous version of Opera Software's self-titled browser is preferred because it was so small and speedy. Although the 4.0 release is a bit larger and slower, it offers enough impressive new features - from a cookie manager to a full-fledged email client - to make this version worth the upgrade for current Opera users. Everyone else, however, should stick with Microsoft Internet Explorer (IE) or Netscape. In a world of free browsers, Opera's $30 price tag is simply too high.

Table 2.2 Requirements and specs for Opera 4.0.

Platform	Windows 95/98/NT 4.0/2000
Processor	486 or higher
RAM	16MB
Disk space	200MB
Downloadable full version	Yes

2.2.7.2 Netscape 6.01 Update

The good: Greatly improved installation process - now actually loads on most computers.

The bad: Still suffers from slow-loading pages, incomplete plug-in support, and occasional crashes.

There is a good reason the Netscape releases a minor 6.01 update to Netscape 6 now, rather than holding out for a full 6.1 designation: It's all about the installation. Whereas version 6 suffered from numerous and various bugs, the fact that lots of people couldn't even install the darned thing was unforgivable. Netscape 6.01 takes care of that problem but not much else.

Table 2.3 Requirements and specs for Netscape 6.01 update.

Platform	PC: Windows 95/98/NT 4.0/2000; Mac: OS 8.6; Linux: Red Hat Linux 6/6.1/7 (with X11 R6)
Processor	PC: Pentium-233; Mac: PowerPC (604e, 266MHz) or G3; Linux: Pentium-233
RAM	64MB (all OSs)

2.2.7.3 Microsoft Internet Explorer 5.5

The good: Print Preview function shows what a Web page will look like before the printing, slight performance improvements.

The bad: Few new features for the average Web surfer.

Internet Explorer 5.5 won't revolutionize the browser world. Developers may appreciate IE's enhanced programmability, but it's not much faster and there's not enough new stuff here to tempt the people to upgrade.

Table 2.4 Requirements and specs for IE 5.5.

Processor	A 486 with a 66 MHz processor or higher (Pentium processor recommended)
Platform	Windows 95/98/Me/NT 4.0/2000. If you are running a version of Windows NT, you must be running Windows NT Service Pack 3 or higher. If you are running the Hebrew or Arabic version of Windows 98, you cannot install the English language version of Internet Explorer 5.5.

RAM	Windows 95/98: 16 MB minimum Windows Me/NT: 32 MB minimum Windows 2000: 64 MB minimum
Disk Space	Minimal install (browser-only): Required for install: 45 MB Required to run: 27 MB after restart Typical install: Required for install: 70 MB Required to run: 55 MB after restart Full install: Required for install: 111 MB Required to run: 80 MB after restart

2.3 Database

Database server is a computer in a LAN dedicated to database storage and retrieval. It is a key component in a client/server environment. It holds the database management system (DBMS) and the databases. Upon requests from the client machines, it searches the database for selected records and passes them back over the network.

A database server and file server may be one in the same, because a file server often provides database services. However, the term implies that the system is dedicated for database use only and not a central storage facility for applications and files.

2.3.1 SQL Server

In 1988, Microsoft released its first version of SQL Server. It was designed for the OS/2 platform and was developed jointly by Microsoft and Sybase. During the early 1990s, Microsoft began to develop a new version of SQL Server for the NT platform. While it was under development, Microsoft decided that SQL Server should be tightly coupled with the NT operating system. In 1992, Microsoft assumed core responsibility for the future of SQL Server for NT. In 1993, Windows NT 3.1 and SQL Server 4.2 for NT were released. Microsoft's philosophy of combining a high-performance database with an easy-to-use interface proved to be very successful. Microsoft quickly became the second most popular vendor of high-end relational database software. In 1994, Microsoft and Sybase formally ended their partnership. In 1995, Microsoft released version 6.0 of SQL Server. This release was a major rewrite of SQL Server's core technology. Version 6.0 substantially improved performance, provided built-in replication, and delivered centralized administration. In 1996, Microsoft released version 6.5 of SQL Server. This version brought significant enhancements to the existing technology and provided several new features. In 1997, Microsoft released version 6.5 Enterprise Edition. This version included 4 GB RAM support, 8-way processor support, and Microsoft Cluster Support. In 1998, Microsoft released version 7.0 of SQL Server. SQL Server version 7.0 is Microsoft's most significant release of SQL Server to date. This version is a complete rewrite of the core engine and administration components. According to the SQL Server development team, the changes to the database engine are designed to provide an architecture that will last for the next 10 years.

Following are several of the key features found in version 7.0:

- Architectural Enhancements
- Simplified Administration
- Data Transformation Service (DTS)
- Performance and Scalability Improvements
- Backup and Restoration Improvements
- Security Enhancements

technical and larger business market for which the NT was designed. For many Windows 95 and Windows 98 users, Windows 2000 may be regarded as a step to take when purchasing their next computer.

The Windows 2000 product line consists of four products:

- **Windows 2000 Professional**, aimed at individuals and businesses of all sizes. It includes security and mobile use enhancements. It is the most economical choice.
- **Windows 2000 Server**, aimed at small-to-medium size businesses. It can function as a Web server and/or a workgroup (or branch office) server. It can be part of a two-way symmetric multiprocessing system. NT 4.0 servers can be upgraded to this server.
- **Windows 2000 Advanced Server**, aimed at being a network operating system server and/or an application server, including those involving large databases. This server facilitates *clustering* and *load-balancing*. NT 4.0 servers with up to eight-way SMP can upgrade to this product.
- **Windows 2000 Datacenter Server**, designed for large data warehouses, online transaction processing (OLTP), econometric analysis, and other applications requiring high-speed computation and large databases. The Datacenter Server supports up to 16-way SMP and up to 64 gigabytes of physical memory.

Windows 2000 is reported to be more stable (less apt to crash) than Windows 98/NT systems. A significant new feature is Microsoft's Active Directory, which, among other capabilities, enables a company to set up virtual private networks, to encrypt data locally or on the network, and to give users access to shared files in a consistent way from any network computer.

2.4.2 Windows NT

Windows NT is a Microsoft Windows personal computer operating system designed for users and businesses needing advanced capability. NT's technology is the base for the Microsoft successor operating system, Windows 2000. Windows NT (which may originally have stood for "New Technology", although Microsoft doesn't say so) is

actually consists of two products: Microsoft NT Workstation and Microsoft NT Server. The Workstation is designed for users, especially business users, who need faster performance and a system a little more fail-safe than Windows 95 and Windows 98. The Server is designed for business machines that need to provide services for network-attached computers. The Server is required, together with an Internet server such as Microsoft's Internet Information Server (IIS), for a Windows system that plans to serve Web pages.

- **Windows NT Workstation:** Microsoft says that 32-bit applications will run 20% faster on this system than on Windows 95 (assuming both have 32 megabytes of RAM). Since older 16-bit applications run in a separate address space, one can crash without crashing other applications or the operating system. Security and management features not available on Windows 95 are provided. The Workstation has the same desktop user interface as Windows 95.
- **Windows NT Server:** The NT Server is probably the second most installed network server operating system after Novell's NetWare operating system. Microsoft claims that its NT servers are beginning to replace both NetWare and the various UNIX-based systems such as those of Sun Microsystems and Hewlett-Packard. NT Server 5.0 essentially became what was renamed Windows 2000.

2.4.3 Linux

Linux is an operating system that was initially created as a hobby by a young student, Linus Torvalds, at the University of Helsinki in Finland. Linus had an interest in Minix, a small UNIX system, and decided to develop a system that exceeded the Minix standards. He began his work in 1991 when he released version 0.02 and worked steadily until 1994 when version 1.0 of the Linux Kernel was released. The current full-featured version is 2.4 (released January 2001) and development continues.

Linux is developed under the GNU (General Public License) and its source code is freely available to everyone. This however, doesn't mean that Linux and its assorted distributions are free - companies and developers may charge money for it as long as the

source code remains available. Linux may be used for a wide variety of purposes including networking, software development, and as an end-user platform. Linux is often considered an excellent, low-cost alternative to other more expensive operating systems.

Due to the very nature of Linux's functionality and availability, it has become quite popular worldwide and a vast number of software programmers have taken Linux's source code and adapted it to meet their individual needs. At this time, there are dozens of ongoing projects for porting Linux to various hardware configurations and purposes.

Linux has an official mascot, the Linux Penguin, which was selected by Linus Torvalds to represent the image he associates with the operating system he created.

2.5 Existing Systems Analysis

In this section, we analyze two existing systems that provide online reservation. They are Air Ticket and Hotwire. This analysis lets us to gain a better understanding about how the online reservation works.

2.5.1 Air Ticket (http://www.air-tickets.net)

Air Ticket offers international flights booking to their customers. The customers just need to fill up the form and waiting for the reply.

Weakness

The customers don't receive the reply immediately after the request form is sent. They are required to check e-mail later to find out the answer of their request. This weakness discourages people to visit Air Ticket's web site since many airline booking systems are able to answer immediately the customers' requestd within a minute. Besides, the travel line of Air Ticket is narrow which it only books international flights that depart from U.S. cities.

2.5.2 Hotwire (http://www.hotwire.com/)

Hotwire is providing their customers with air ticket booking, hotel booking and cars rental services. It is able to answer the customers' request quickly in just few seconds time. They also provide information in best deals that offers significant savings to customers and send e-mail to their customers to update on the latest deals, news and exclusive offers.

Weakness

This site is overwhelming. Most customers do not have time to read or even browse through the information.

2.5.3 Solutions

The PBTA System is easy to understand and use since it doesn't contain too much information and this should encourage more people to visit the site. Besides, the new project is concentrate on bus ticket reservation only. As a result, customers who are interested in bus ticket reservation can avoid wasting the time to read through any unrelated information.

2.6 Summary

There are plenty of knowledge and skills have to be manipulated before develop a web-based application. A thorough research is necessary to determine the most suitable environment and tools to be used for the system. For example, the web server is related with operating system in which we are using. Such as if we are Windows 2000 users, and then it is cleverer and much convenient for us to use IIS than other web servers since IIS is built in Windows 2000. Moreover, the more powerful one technology is, normally the much difficult to manage it. There are, of course, more weighty matters to consider, like

speed and stability. In the next chapter, Methodology and System Requirement, the methodology that used for the system development will be explained. Besides, the web technologies to be used are chosen based on the research stated above.

Chapter 3
Methodology and System Requirement

The criteria taken under consideration before choosing a suitable methodology for the PBTA system include its advantages, disadvantages and phases comparing with other methodologies. Meanwhile the determination of all necessary requirements including functional requirements and non-functional requirements is made. This chapter also discusses the information gathering techniques.

3.1 Methodology

"Waterfall model with prototyping" is adapted as the system approach in the development process of this project. Waterfall model, illustrated in Figure 3.1, depicts the stages as cascading from one another. It presents a very high-level view of what goes on during development and suggests the sequence of events that should expect to encounter.

The waterfall model is chosen because it lays out what we need to do in each stage. Besides, it makes explicit which intermediate products are necessary in order to begin the next stage of development. On the other hand, many others or more complex models are really just embellishments of the waterfall.

The prototype is included to enhance the understanding of PBTA System. A prototype is a partially developed product that enabling the examination of some aspect of the proposed system. It helps to determine the aspect being tested is suitable and appropriate for the final system. For example, the user interface can be built and tested as a prototype, so a better sense of how the users like to interact with PBTA System can be gained.

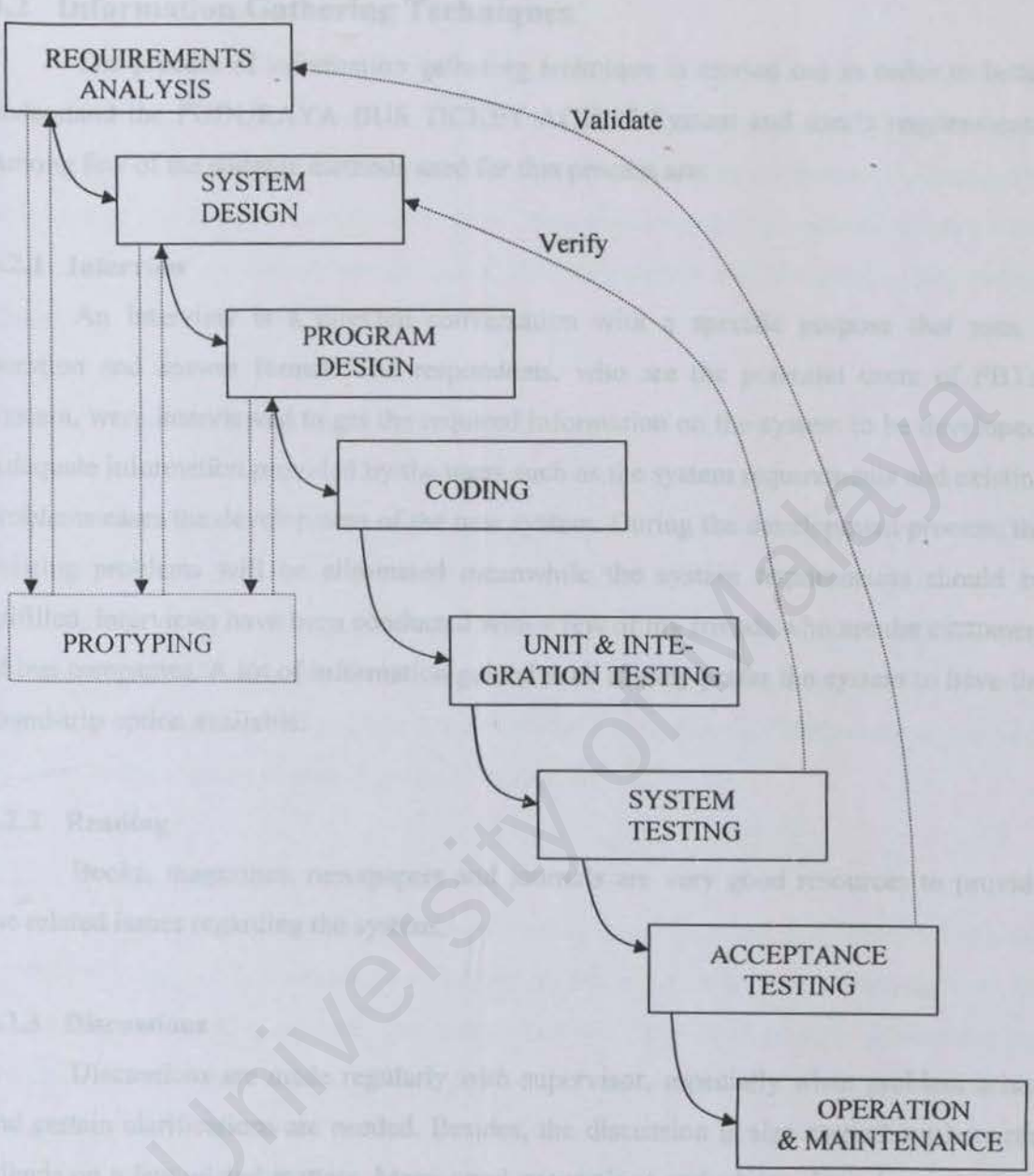


Figure 3.1 The waterfall model with prototyping.

3.2 Information Gathering Techniques

The process of information gathering technique is carried out in order to better understand the PUDURAYA BUS TICKET AGENT System and user's requirements. Among few of the suitable methods used for this process are:

3.2.1 Interview

An interview is a directed conversation with a specific purpose that uses a question and answer format. The respondents, who are the potential users of PBTA System, were interviewed to get the required information on the system to be developed. Adequate information provided by the users such as the system requirements and existing problems eases the development of the new system. During the development process, the existing problems will be eliminated meanwhile the system requirements should be fulfilled. Interviews have been conducted with a few of my friends who are the customers of bus companies. A lot of information gained such as they prefer the system to have the round-trip option available.

3.2.2 Reading

Books, magazines, newspapers and journals are very good resources to provide the related issues regarding the system.

3.2.3 Discussions

Discussions are made regularly with supervisor, especially when problem arises and certain clarifications are needed. Besides, the discussion is also carried out between friends on a few related matters. Many good suggestions and advices have been obtained through the discussions to overcome the problems and improve the system design.

3.2.4 Internet Surfing

The Internet is the largest storehouse of information in the world. It is used to get information that is applicable worldwide. Most of information stated in Chapter 2 is obtained from Internet Surfing including the comparison of existing systems.

3.3 Virtual Systems

In order to make PBTA System works properly, one Virtual Bus Company System (VBCS) and one Virtual Banking System (VBS) have been created. Each virtual system plays an important role to enable the PBTA System to automate or simulate the activities of bus companies. However, both virtual systems are beyond the scope of this project and they are created because needed in the system implementation and testing phases.

3.3.1 Virtual Bus Company System (VBCS)

Virtual Bus Company System represents bus companies that linked with PBTA System. It is needed during the information acquiring and booking process of PBTA System. The main records that should be kept in VBCS are bus schedule, bus company's name and available tickets. The PBTA System needs to access the database of VBCS to retrieve the related information requested by users. In the booking procedure, the PBTA System returns the detail of booked ticket for VBCS to update its database so as ensuring no same ticket is being booked by more than one person.

3.3.2 Virtual Banking System (VBS)

Virtual Banking System plays the role of an acquiring bank and card-issuing bank for PBTA System. It is compulsory as third party that must exist in online transactions for monitoring the booking process. The main function of this third party is performing the authentication for the user's identity to avoid fraud. Moreover, it is responsible for transferring an adequate amount of payment from the user's account to the merchant's account. The third party is not necessarily a bank, but could be an Independent Sales Organization (ISO) or the First Virtual Holdings. The assumption is made that every bus company has established its own merchant account with VBS. During the real booking process, the Acquiring Bank should authenticate the identity of users and transfer the payment to the related merchant account. However, since the VBS is beyond the scope of project, it is appropriate to simplify the actual procedure. As the result, VBS only authenticates the identity of users and acquires the approval from users regarding the transaction before the authorization is sent to the PBTA System. It means neither the

merchant account nor user account is needed for VBS as well as the transferring of payment.

3.4 Requirements Analysis

Requirements describe the behaviors and activities of a system, such as its reaction to input, and the state of each entity before and after an activity occurs. There are two types of requirements:

- Functional requirements;
- Nonfunctional requirements

3.4.1 Functional Requirements

A functional requirement describes the interactions between the system and its environment. It also describes how the system should behave when given certain stimuli. The functional requirements of PBTA System are listed in Table 3.1.

Table 3.1 Functional Requirements for PBTA System.

Module	Description
Account Module	• This module provides four main functions to the users that listed as below: **1. New** – Allows users to create their new profile. **2. Edit** – Allows users who are members of PBTA System to edit their profile including change their password. **3. Access** – For users to log in and log out the system.

Search Module	• Depending on the users' request, this module will gather the related information from the bus companies and then arrange the results before returns to the users.
Book Module	• This module takes part in processing the booking request from the users • Its functions can be divided as below: **1. Order** – For users to book the new ticket. **2. View** – For users to view their reservation records, if the records exist. **3. Change/Cancel** – Activated when users would like to change or cancel the reservation that has been made. **4. Hold** – This function works in a concert with the Email Module. – The users can use hold whenever the ticket requested is not available currently, but they would like to be informed through the email if the ticket become available again, for example when someone has made the change or cancellation.
Email Module	• Activated when receiving the detail of ticket from the Booking Processing Module.

	• Perform the checking process automatically to find out whether any hold requests match with the ticket. • If found, automatically generates the email and send to the corresponding users' email accounts.
Maintenance Module	• This module only available to system administrator. • Administrator is login as super user and all the functions provided to users are also reachable by administrator. • Administrator is able to perform additional functions that stated as below: **1. Super View** – View all the data that kept in the database of PBTA System including members' password, reservation records and members' personal detail. **2. Maintain** – Administrator has the right to edit the profile of members, overwrite members' passwords, and even remove the members' record from the database.

3.4.2 Non-Functional Requirements

Non-functional requirements or constraints describe the restrictions on the system that limits choices for constructing a solution to the system. Such constraints usually narrow down the selection of programming languages, platform or implementation techniques. The following lists the non-functional requirements of the system:

3.4.2.1 Easy to use

Complete user guides and documentation would be provided, as to ensure that users should be able to handle and operate the system by themselves. Help functions are also provided throughout the system in order to guide users when they encounter any problems.

3.4.2.2 Graphical and friendly user interfaces

Graphical User Interfaces (GUIs) are to be implemented throughout the system to provide a very user-friendly interface and to assure ease of use to the users. GUIs eliminate the need of memorize commands, and can even be operated by non-technical staffs. Hence, GUI enables users with no or little technical background to be able to operate the system well and to use it to the maximum.

3.4.2.3 Security

The application would only allow authorized users with the correct login and password to access and manipulate the data kept in the database. The effective handling procedures will also help the user from terminating the application immaturely.

3.4.2.4 Reliability

This system should be reliable which means that it does not produce dangerous or costly failures when it is used in a reasonable manner that is in a manner that typical users expect.

3.4.2.5 Robustness

This system should be robust. Robustness refers to the quality that causes a system to be able to handle or at least avoid disaster in the face of unexpected circumstances such as given improper data.

3.4.2.6 Efficiency and effective

In computer terminology, efficiency means a procedure that can be called or accessed in unlimited number of times to produce similar outcomes or output at a creditable pace or speed. Effectiveness means that the input and output screens serve specific purpose in the system.

3.4.2.7 Maintainability

A system is maintainable if the programs are easily understood by the maintenance programmer and are easy to modify and to test when updating to meet new requirements, rectifying a deficiency, correcting errors or moving to different computer systems.

3.4.2.8 Simplicity and Attractiveness

This refers to keeping forms and screen properly uncluttered in a manner that focuses the user's attention. Attractiveness refers to the user's enjoyment or attraction to use the system due to their appealing design.

3.5 Software Tools Chosen

Based on the research done in the Chapter 2, it is obvious that a variety of programming languages or technologies can be used to develop PBTA System. In this section, the programming languages to be used are decided. Those aspects that have been taken under consideration include the advantages, disadvantages, requirements and the abilities of languages. After a thorough consideration, we have decided to use the technology or language stated below:

3.5.1 Active Server Page 3.0

The web-based application technology that we would like to use is Active Server Page (ASP) 3.0. Though from the comparison made, JSP is more powerful than ASP, such as it supports all kinds of web servers, but ASP can only be ran by Information Internet Server (IIS) or Personal Web Server (PWS). However, one edge that ASP has over JSP is its ease to learn or manipulate. Since this project schedule has a quite short

period, it is advisable to spend as little time as possible to manage all the technologies or skills needed. On the other hand, ASP shows greater ability than other web-based technologies. ASP is able to create dynamic web pages that cannot be done by using CGI. It is also five times faster than CGI. Other disadvantages of CGI that have discouraged me to use it are CGI is not inherently multi-threaded which limits the number of concurrent users and it uses a greater amount of server resources that cause performance degradation of servers and sites. In addition, ASP also outperforms ColdFusion. Executing ASP codes are much faster compared to ColdFusion. The features that make ASP suitable for this system are:

- ASP is suitable for building multi tier client/server application like PBTA System. It is able to spread processing load between client and server by implementing and integrating client-side as well as server side processing.
- ASP works with Internet Information Server to provide secure information sharing across networks as well as access to various database management systems.

3.5.2 Windows 2000 with Internet Information Server 5.0 (IIS 5.0)

To run ASP, the best choice of web server is the Internet Information Server. That is why Windows 2000 is chosen as the platform for PBTA System, as the Internet Information Server 5.0 (IIS 5.0) is built into all versions of Windows 2000. So by using Windows 2000, it only requires that IIS 5.0 component is installed. On the other hand, use of other platforms require downloads or a purchase of ASP-supporting web server. However, many web servers not come with ASP built-in and some web servers are not capable of supporting ASP at all. For example, we can use Personal Web Server (PWS) as the web server for platforms Windows NT Workstation, Windows 95 or Windows 98. But the weakness is that PWS only supports ASP 2.0, which is not as powerful as ASP 3.0. Indeed, there are still many web servers available. Netscape's web server is available commercially. Others, such as Apaches web server are available for free. Some of these web servers may support ASP and others may not. To sum up, using Windows 2000 with

IIS 5.0 is best choice since it will not cause any extra-cost for PBTA System and we need not worry about any integration or crash problem.

3.5.3 HTML and VBScript

HTML is the essential language to be used for creating web pages. In addition to being a markup language for displaying text, images and multimedia, HTML provides instructions to web browsers in order to control how documents are viewed and how they relate to each other. For all its simplicity, HTML is a very powerful language. HTML allows the individual elements on the web to be brought together and presented as one collection. Text, images, multimedia and other files can be packaged together using HTML.

Of course, there are quite a number of scripting languages. But the two most popular at the moment are VBScript and JavaScript. But VBScript is used because it is easier to learn than JavaScript. Visual Basic Scripting Edition or VBScript is Microsoft's scripting language for the Internet. The abilities to provide scripting, automation and customization capabilities for web browsers are a major feature of VBScript. VBScript embedded into HTML files extends HTML into something more than a page-formatting language. Pages with VBScript can change every time they are loaded into browser. They can also respond intelligently to user actions. VBScript is both a client-side and server-side programming language. A client-side programming language is a language that can be interpreted and executed by a browser. A server-side programming language is a language that executes on the server that serves a web site's files.

3.5.4 Microsoft SQL Server 7.0

Microsoft SQL Server 7.0 was chosen as the database of PBTA System. It is a scalable, high performance database management system designed specifically for distributed client/server computing. There are several important features in SQL Server 7.0 as stated below:

- Easy-to-use Interface

  SQL Server includes a set of administrative and development tools that improve the user's ability to install, deploy, manage and use SQL Server across several sites. Examples of administrative tools are SQL Enterprise Manager, SQL Agent, SQL Server Profiler and so on.

- Scalability

  The same database engine can be used across platforms ranging from laptop computers running OS Windows 95 to larger, multiprocessor servers running Microsoft Windows NT as the same programming models is shared in all environments.

- System Integration with Other Server Software

  SQL Server integrates with e-mail, Internet and Windows. For example, SQL server works with Microsoft Windows NT Server. Security and encryption facilities to implement secure data storage. Besides, it also supports web pages containing ASP.

- Powerful Database Engine for Empowering Web Site

  Through tight integration with Internet Information Server, SQL Server can be queried and updated via popular web browsers. This interoperability is enabled by SQL Server's native ODBC together with Internet Database Connector interface included in Internet Information Server.

3.5.5 Microsoft Visual InterDev 6.0

There are a number of different text editors and other applications that can be used to create or edit ASP pages. But Microsoft Visual InterDev 6.0 is chosen as our web application development tool. Visual InterDev (VI) comes as part of Microsoft's suite of professional programming tools, known as Visual Studio. VI is a tool for designing dynamic web applications. It is, in effect, just a development environment and a collection of useful tools and utilities.

Nowadays VI 6.0 is the tool that Microsoft is promoting as their favored ASP editing tool. One simple but very useful feature of VI 6.0 is that it highlights ASP <% and %> tags in yellow, and the ASP script itself is highlighted using the blue for legal keywords – so they stand out from the HTML. It also provides the WYSIWYG (What You See Is What You Get) Interface. This allows the developers to put together in much the same way as they might do when creating a document in Microsoft Word – they can insert pictures, links and sounds without having to write a single line of HTML.

In addition, Visual InterDev boasts strong links with SQL Server, which makes it very easy to set up databases combining ASP and SQL Server. It also provides several useful web-based tools for doing things like checking links, highlighting the broken ones on the site and allowing the drag-and-drop pages from one location to another.

3.6 System Requirements

The choice of hardware and software used for the system is very important as it has a profound impact on cost, quality and productivity of the system.

3.6.1 Hardware Requirements

3.6.1.1 Server Side

Given below are the specifications of the hardware that are required for the implementation of this system:

- Processor: Pentium 166 or above
- Operating System: Windows 2000 environment
- Memory: 64 MB or above
- Hard Disk: 5 GB or above
- Keyboard and mouse as input devices
- VGA monitor
- Windows 2000-compatible network adapter card and related cable

3.6.1.2 Client Side

The client hardware requirements are quite minimal, as long it has a reasonable amount of RAM, a web browser and is able to connect to Internet. The recommended configurations are:

- Processor: Pentium 486 or higher
- Operating System: Windows 95 or higher
- Memory: Minimum 32 RAM
- Modem and telephone line or other compatible devices for accessing the Internet
- Mouse and Keyboard as input devices
- VGA or higher resolution monitor

3.6.2 Software Requirements

3.6.2.1 Server Side

To host and run this system, the server computer needs to have various supporting software installed. The software that should be installed in the server residing in PBTA System is:

- Windows 2000 platform
- Internet Information Server 5.0 (IIS 5.0)
- Microsoft SQL Server 2000

3.6.2.2 Client Side

The client software requirements are very simple. The most important software for them to use PBTA System is the browser. The following describe the specification of client software:

- Windows 9x/ME/2000
- Internet Explorer

3.7 Summary

This chapter gives an insight into the systems methodology, the steps that are taken to ensure a completion of the system. Other than that, the information gathering

techniques are also discussed. The system requirements, the software that are being used among others are also specified. The Chapter 4 will be discussing about the system design phase of the PBTA System.

Chapter 4 System Design

4.1 Preface

If the requirements represent the problem that the system is to solve, then the design is the creative process of transforming the problem into solution or the description of a solution. The designs have to satisfy all the requirements in the specification. In many cases, the number of possible solutions is limitless such as developers can choose to implement one solution from among the several possibilities. The nature of the solution may change as the solution is described or implemented. In the same way, the description of a system may change during the development cycle. System design describes exactly what the system will do. In this chapter, the system design is described in a detail of how the system is able to meet the requirements identified during system analysis.

Thus, in order to achieve a good design and software quality, three characteristics that serve as a guide for the evaluation are suggested:

i. The design must implement all the explicit requirements contained in the analysis made and it must accommodate all the implicit requirements desired.
ii. The design must be a readable and understandable guide for those programmers, testers and trainers who carry out the maintenance to the system.
iii. The design should provide a complete picture of the system, addressing the data, functional and behavioral domains from an implementation perspective.

4.2 Program Design

PBTA System consists of two main modules: Users Module and Administrator Module. As illustrated in Figure 4.1, PBTA System Structure Chart, users can access 3 modules of PBTA System – Account Module, Book Module and Search Module. Each module offers specific functions to users. Account Module in charge of the account information of users. It allows users to create a new profile, edit or update their profiles,

access PBTA System i.e. login and logout the system and change their passwords if they want to. Book module is the core of PBTA System, which allows users order a new ticket, change or cancel their reservation, retrieve their reservation records and even hold the request for the tickets that are currently unavailable. Search module also as important as the Book module. It is the sole module that can be accessed by non-member and member users. As its name implied, Search module helps users to gather all related trip information from bus companies so as users need not to visit those bus companies' homepages themselves.

On the other hand, administrators are allowed to access all the modules that are accessible by users. In addition, administrators can perform some specific functions that are not reachable by the users. They can view all the data that are stored in the database of PBTA System using function Super View in Maintenance module. Moreover, administrators have the right to overwrite the passwords of users and even remove completely the members' records from the system if they consider the accounts have not been accessed for quite a long period.

Besides of that, PBTA System contains Email module that can perform its function automatically. It is used to generate the e-mail to the members who have made the hold requests whenever the hold requests match with the tickets that are just been cancelled or changed. This module is triggered by the Book module and work in concert with it.

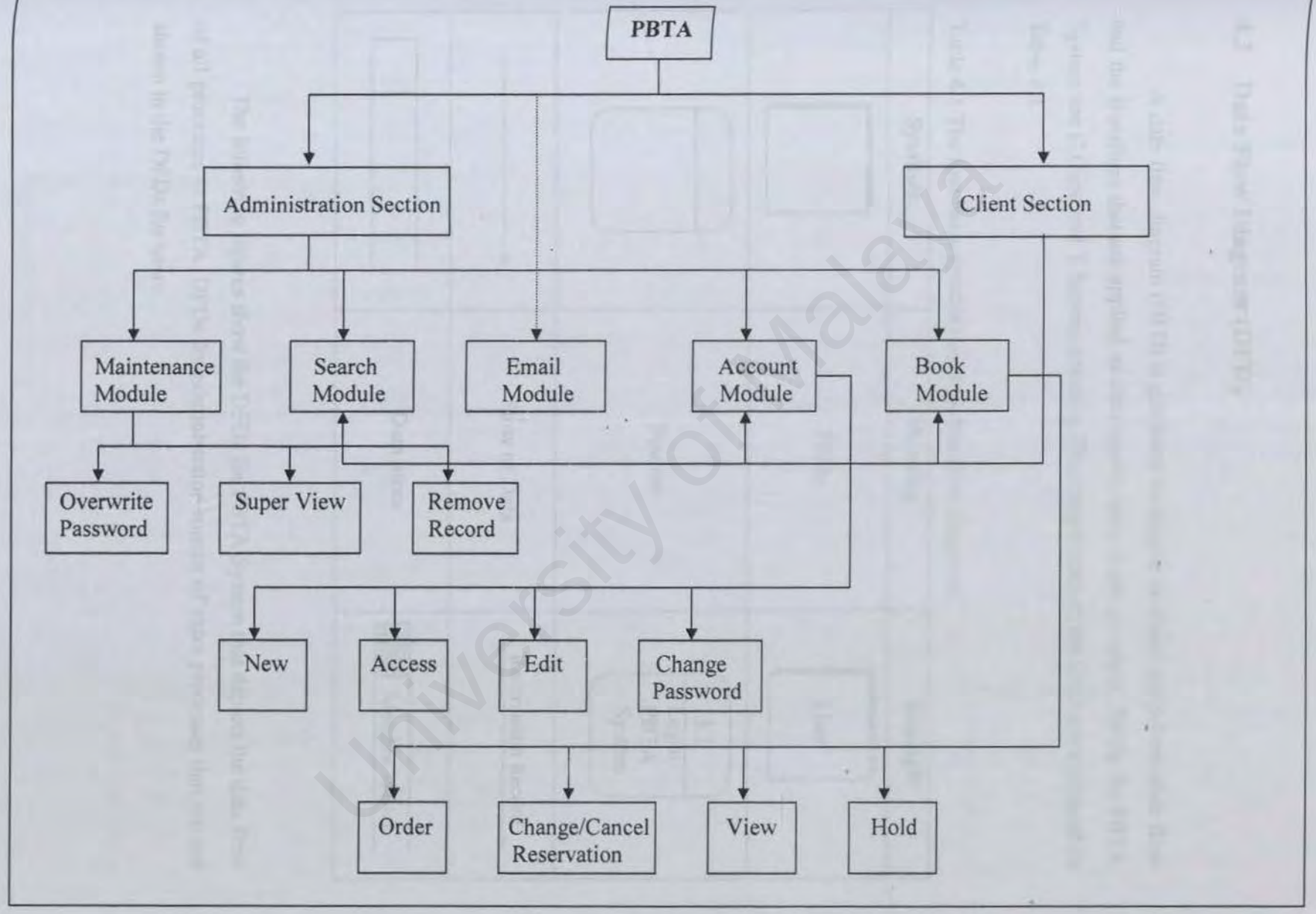
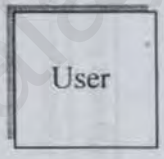
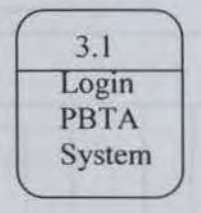
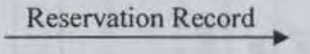
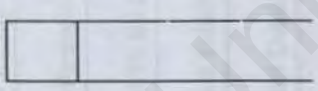
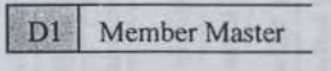


Figure 4.0 Structure chart of PBTA System.

4.3 Data Flow Diagram (DFD)

A data flow diagram (DFD) is graphical technique to depict the information flow and the transform that are applied as data moves from input to output. DFDs for PBTA System use C.Gane and T.Sanson notation. The components of the DFD are explained in Table 4.1.

Table 4.1 The four basic symbols used in data flow diagrams.

Symbols	Meaning	Example
	Entity	
	Process	
	Flow of Data	
	Data Store	

The following figures show the DFDs for PBTA System that depicts the data flow of all processes in PBTA. DFDs for administrator consist of extra processes that are not shown in the DFDs for users.

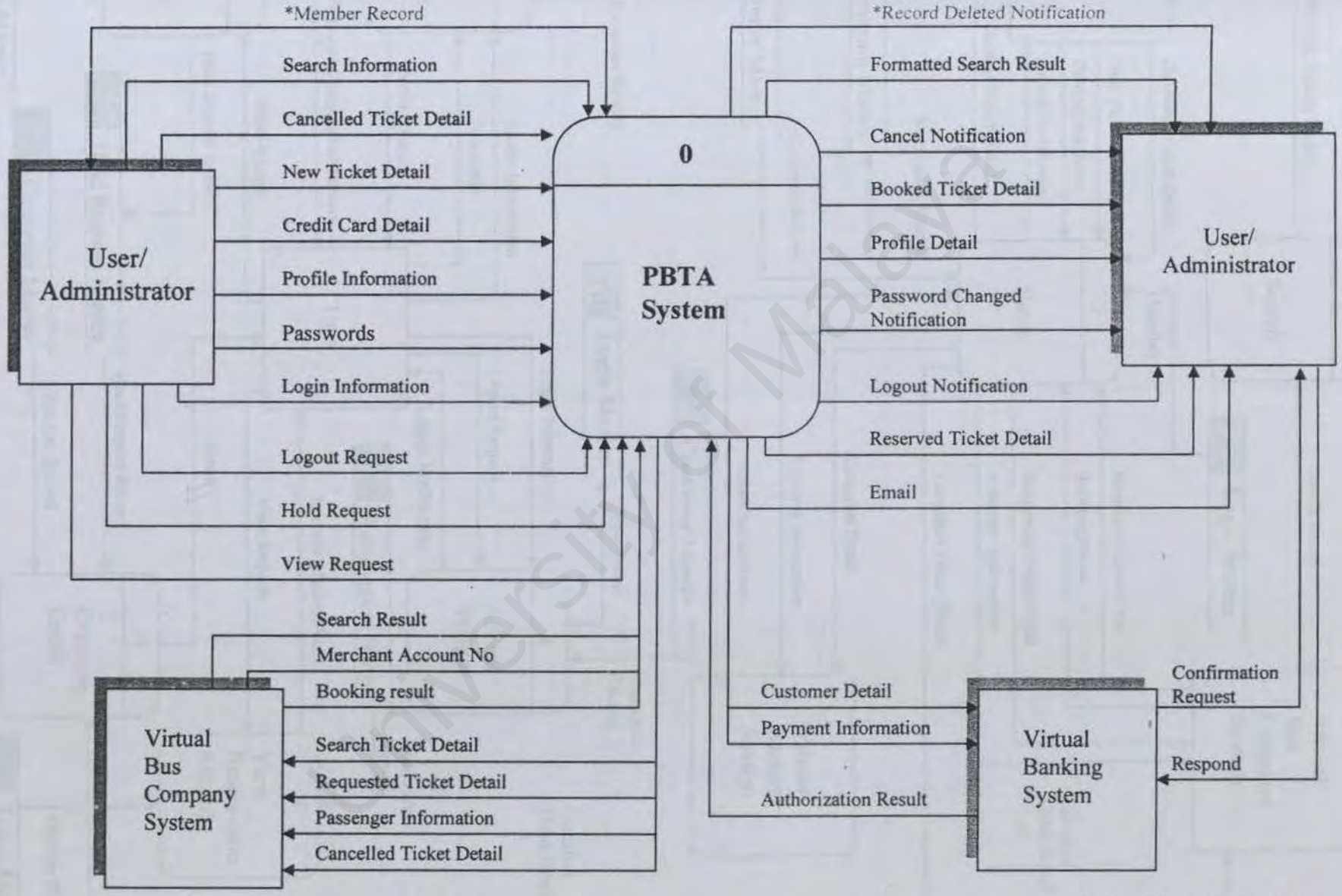


Figure 4.2 Context Diagram for PBTA System.

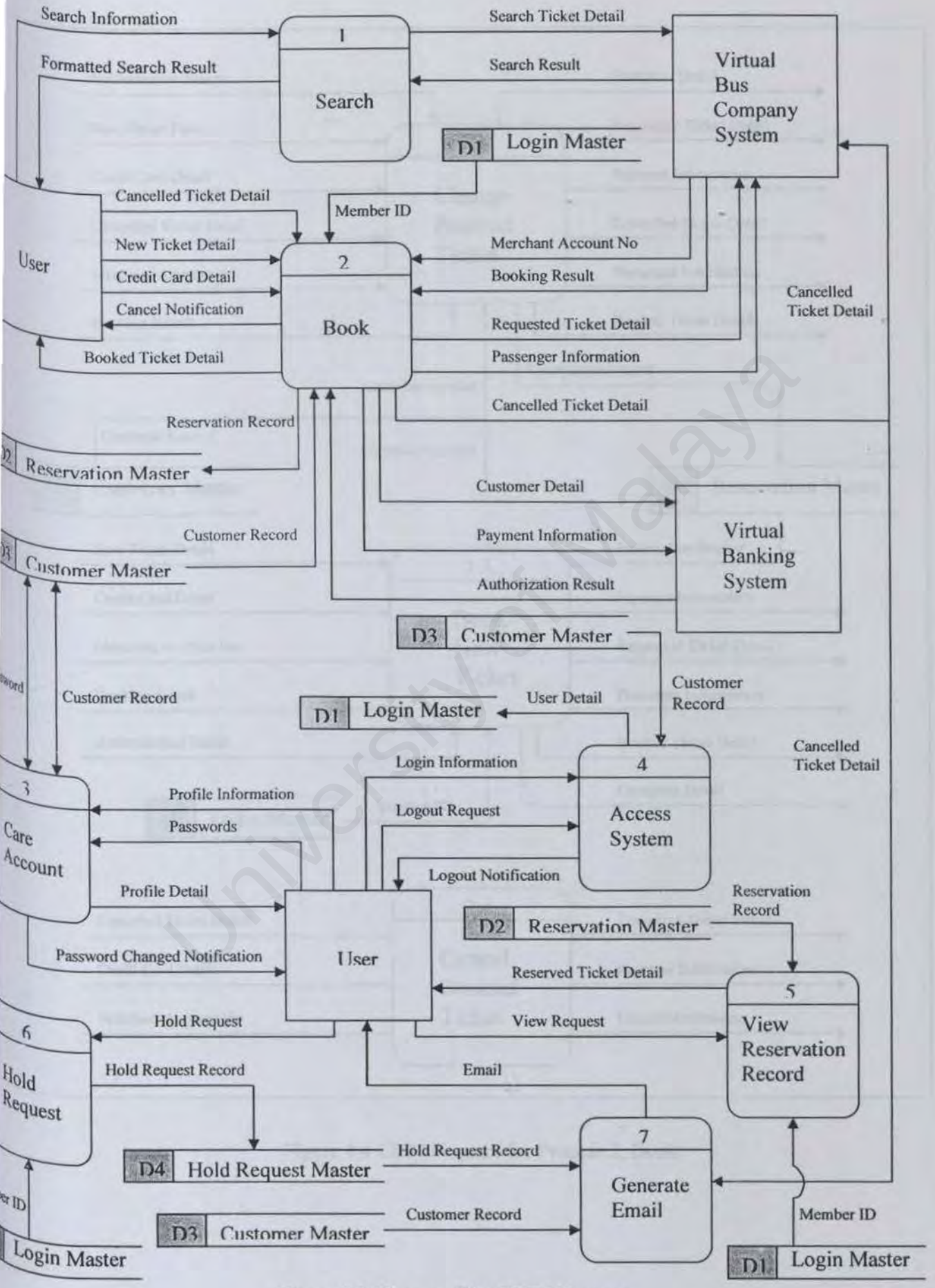


Figure 4.3 Diagram 0 for PBTA System.

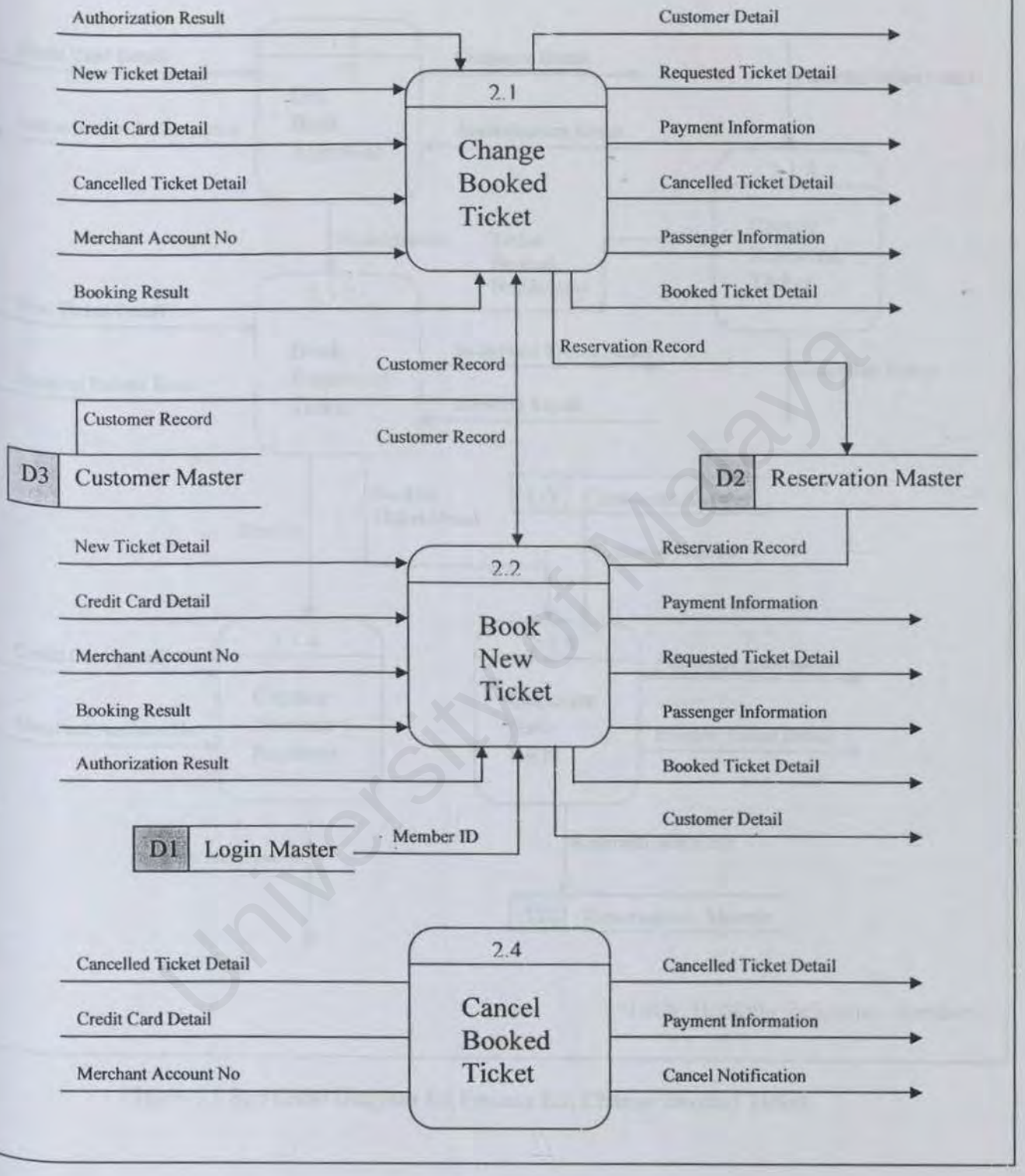


Figure 4.4 Child diagram for Process 2, Book.

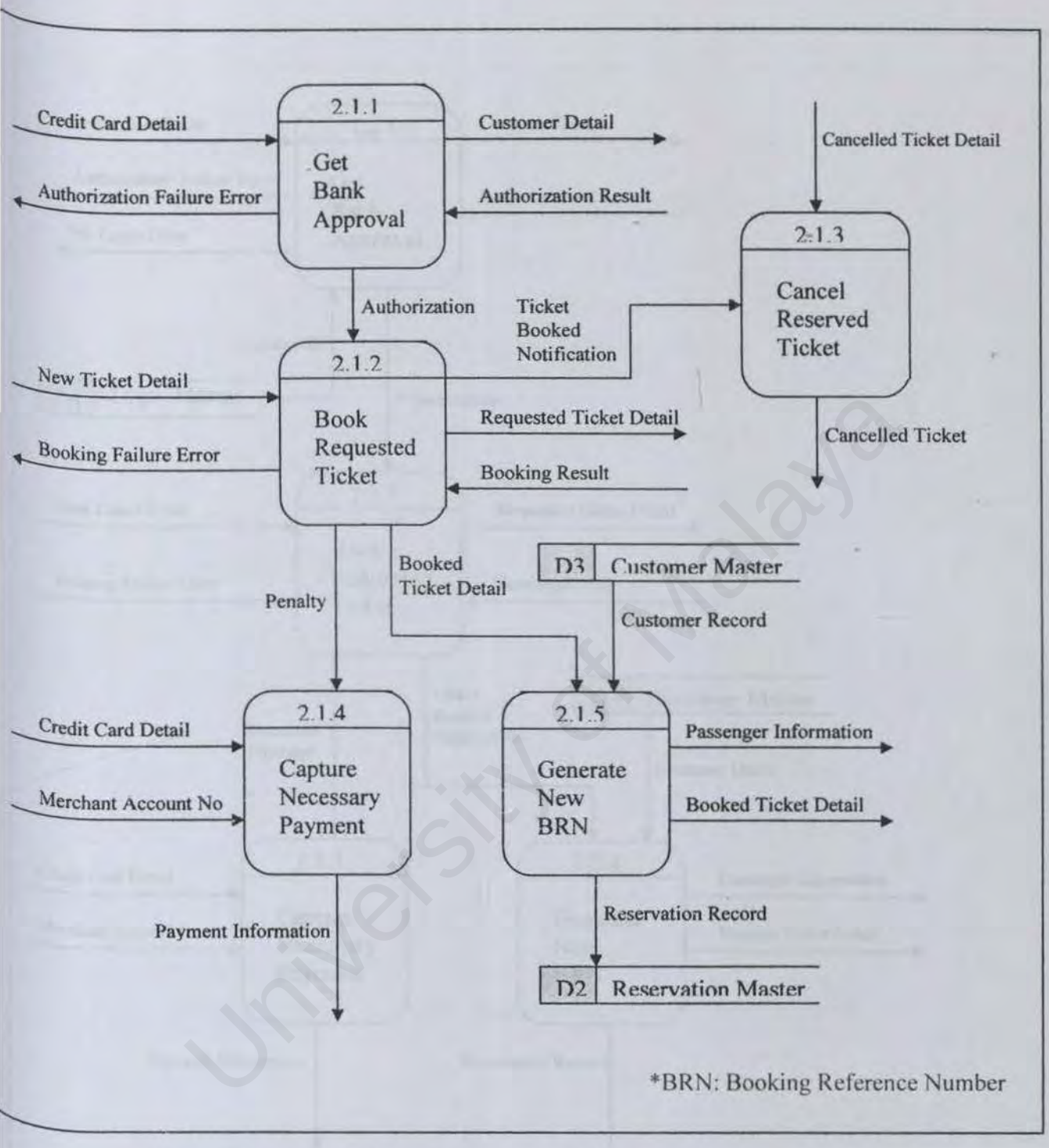


Figure 4.5 Sub Child Diagram for Process 2.1, Change Booked Ticket.

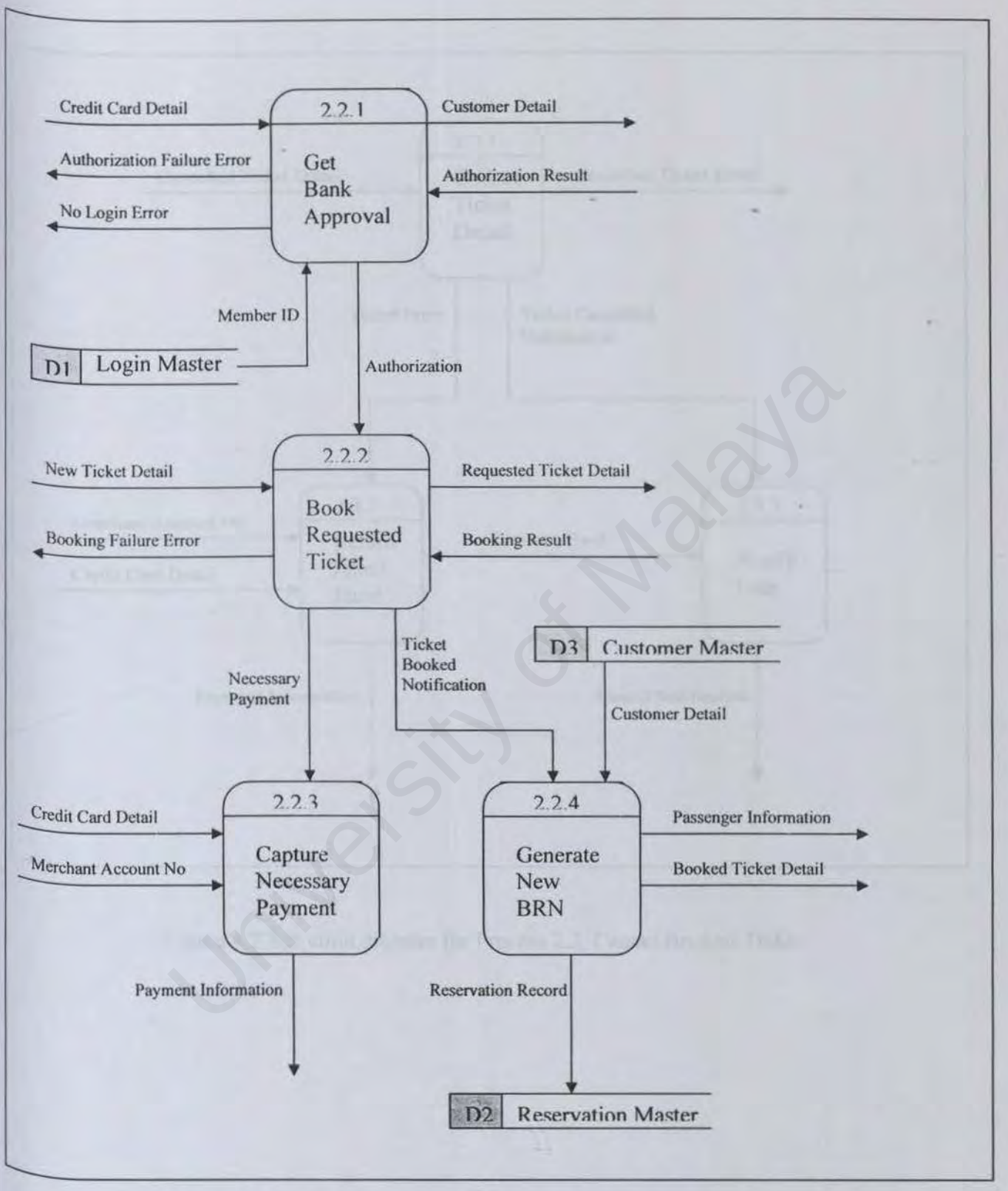


Figure 4.6 Sub child diagram for Process 2.2, Book New Ticket.

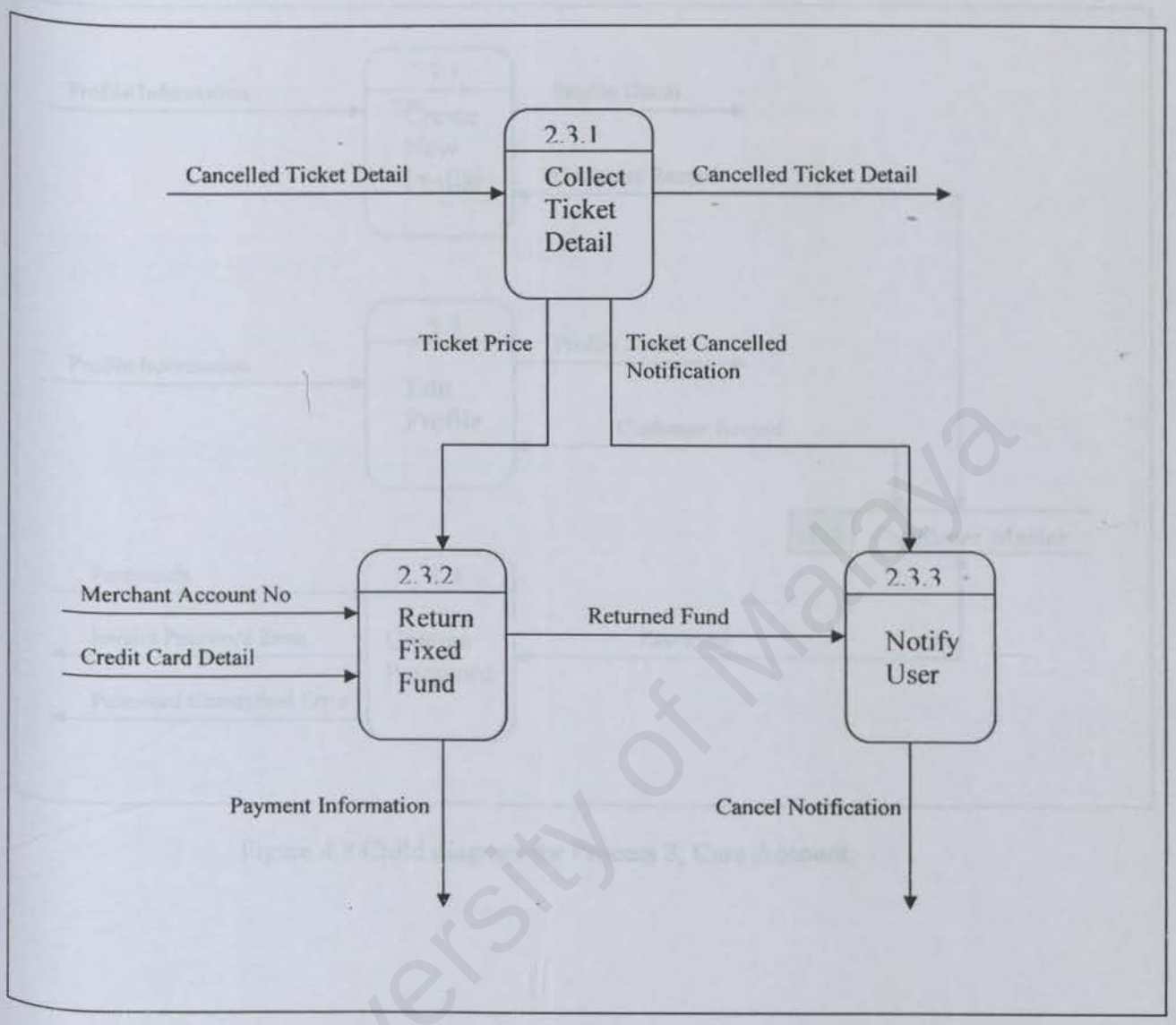


Figure 4.7 Sub child diagram for Process 2.3, Cancel Booked Ticket.

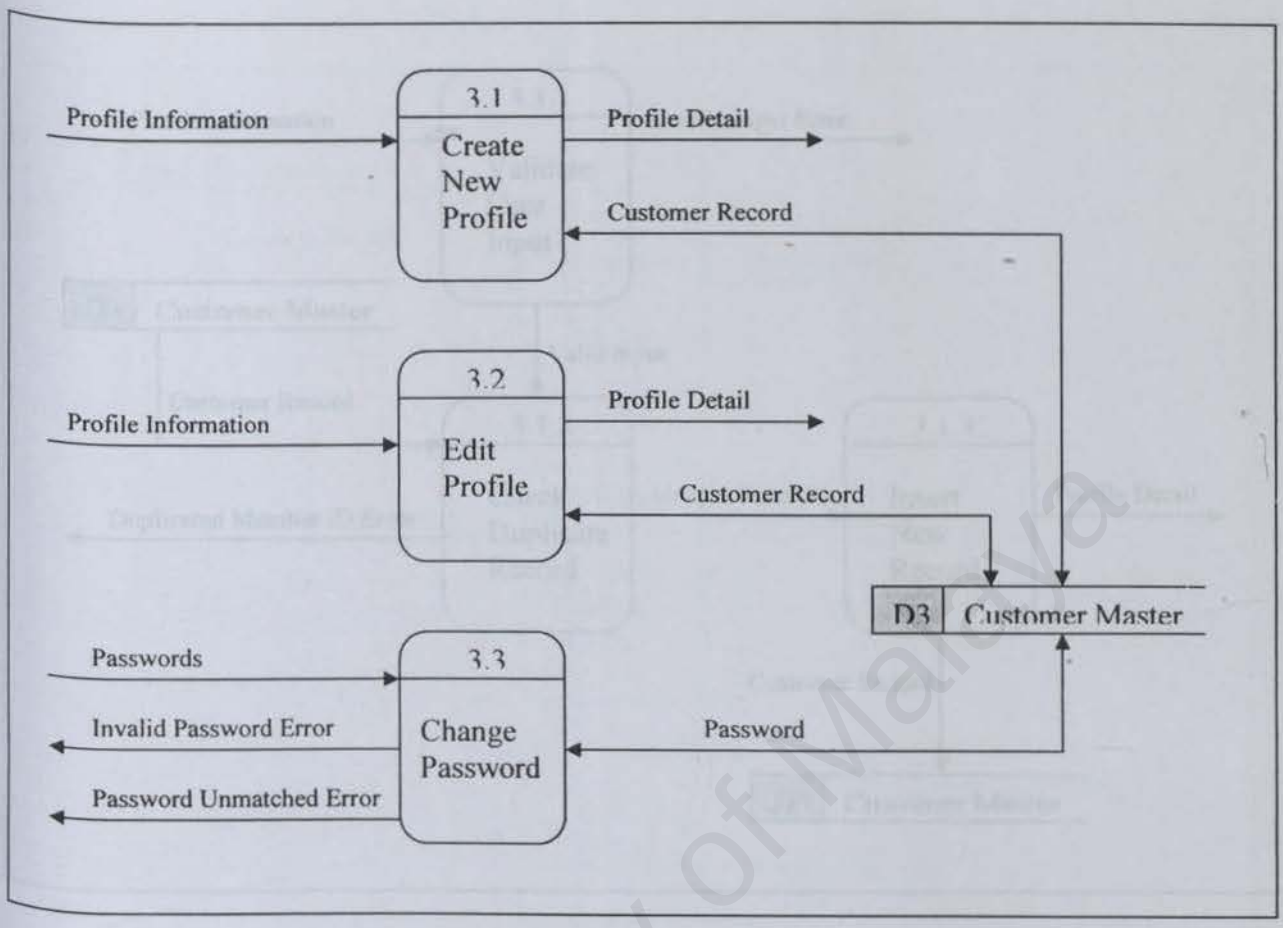


Figure 4.8 Child diagram for Process 3, Care Account.

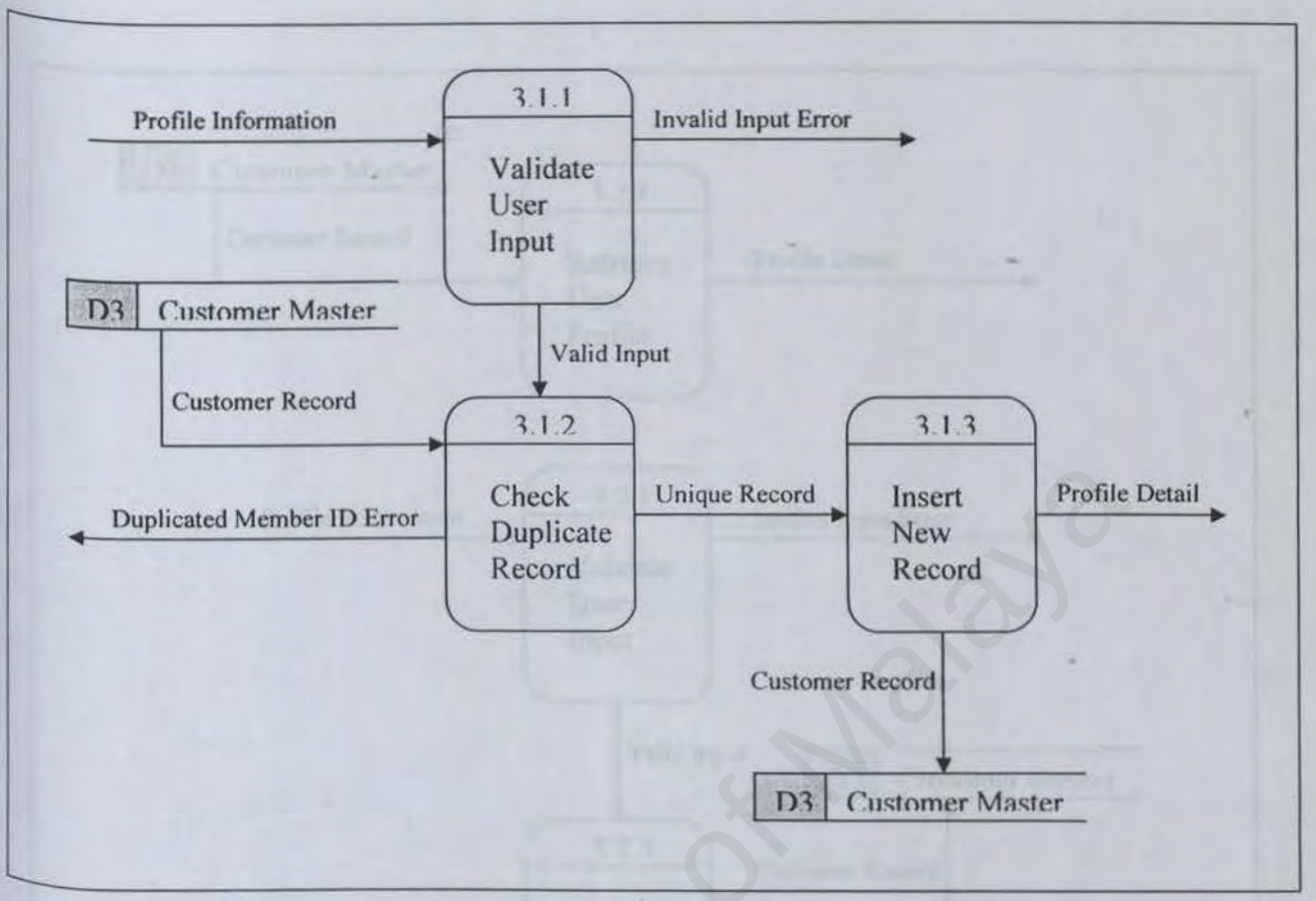


Figure 4.9 Sub child diagram for Process 3.1, Create New Profile.

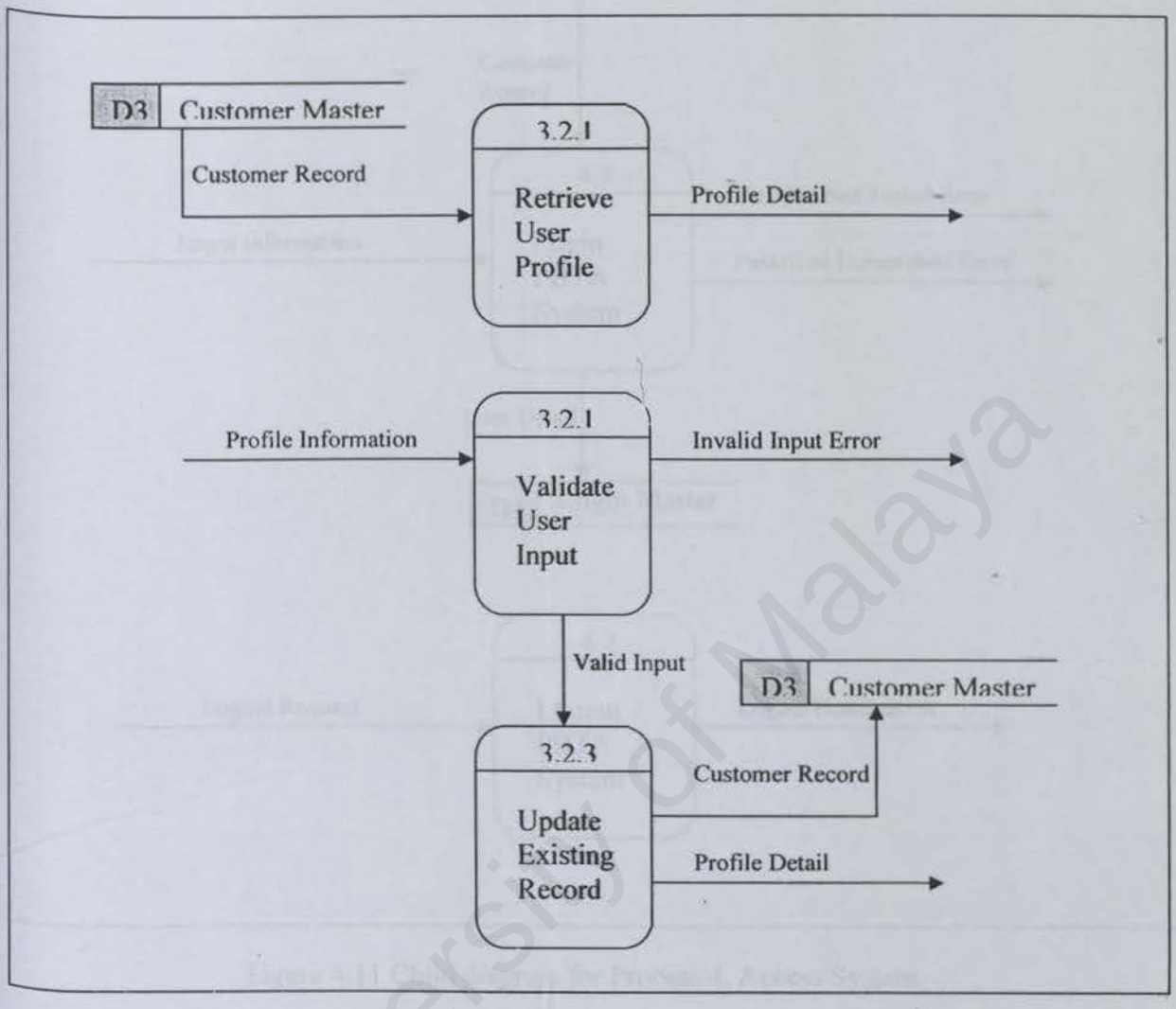


Figure 4.10 Sub child diagram for Process 3.2, Edit Profile.

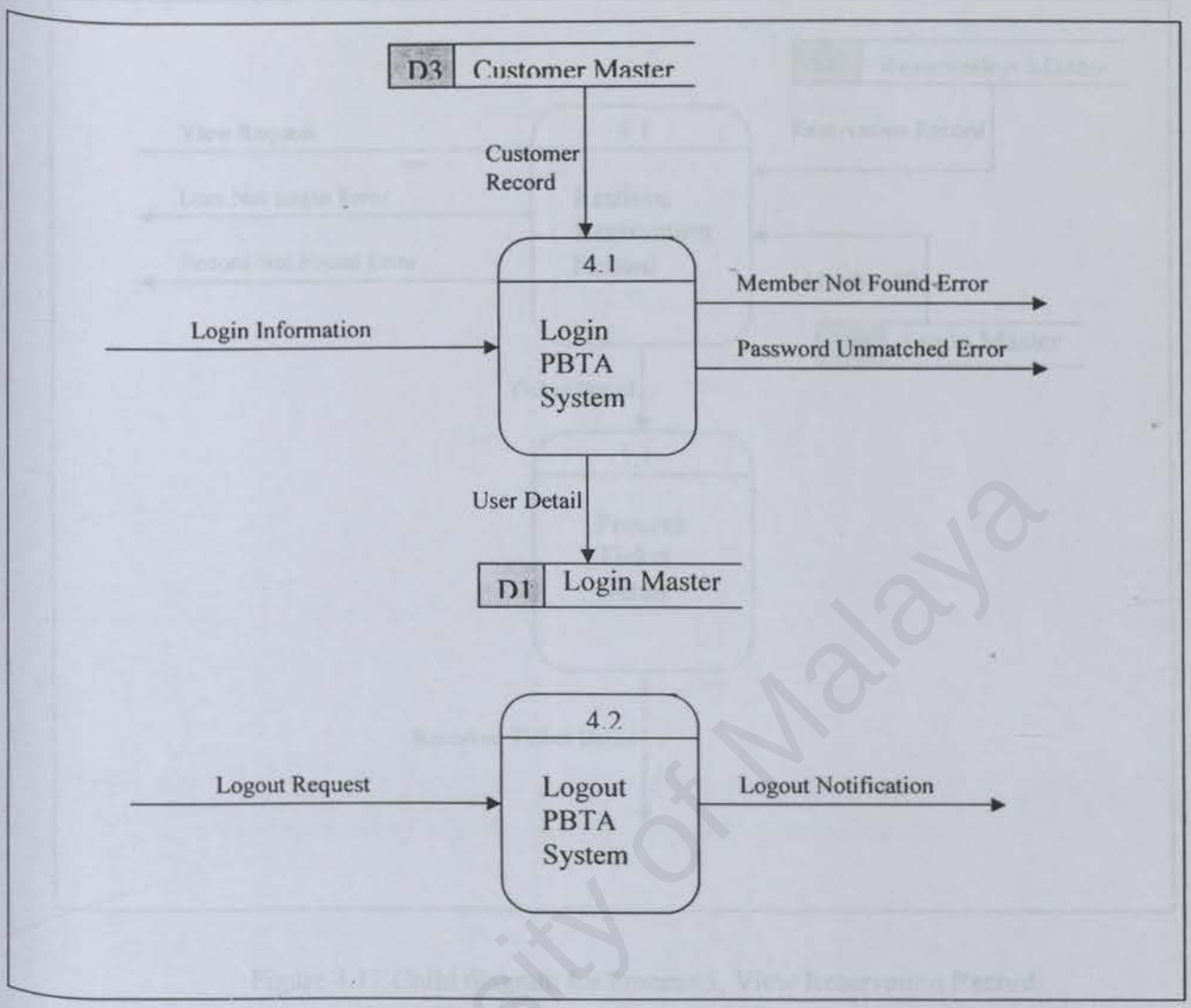


Figure 4.11 Child diagram for Process 4, Access System.

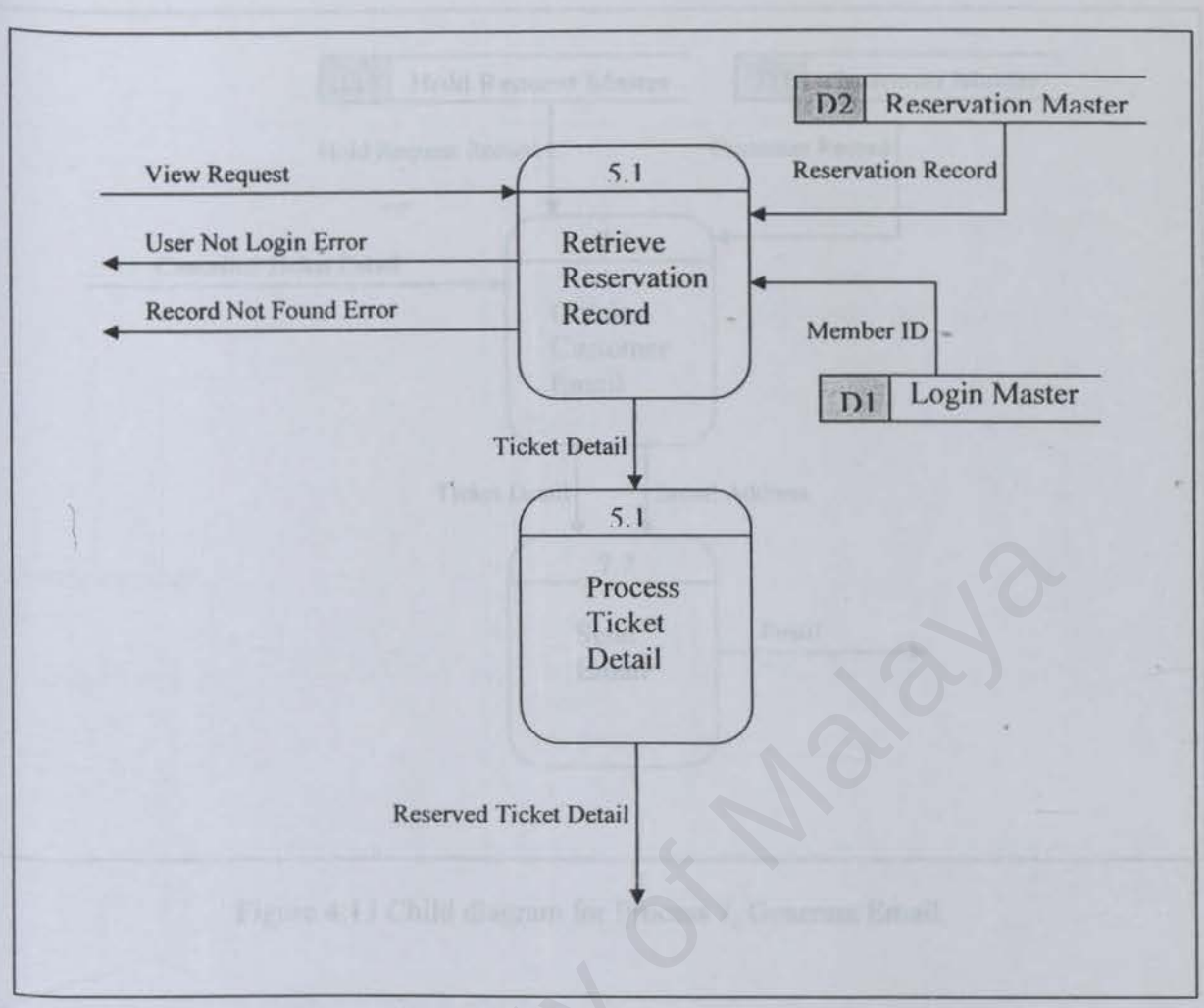


Figure 4.12 Child diagram for Process 5, View Reservation Record.

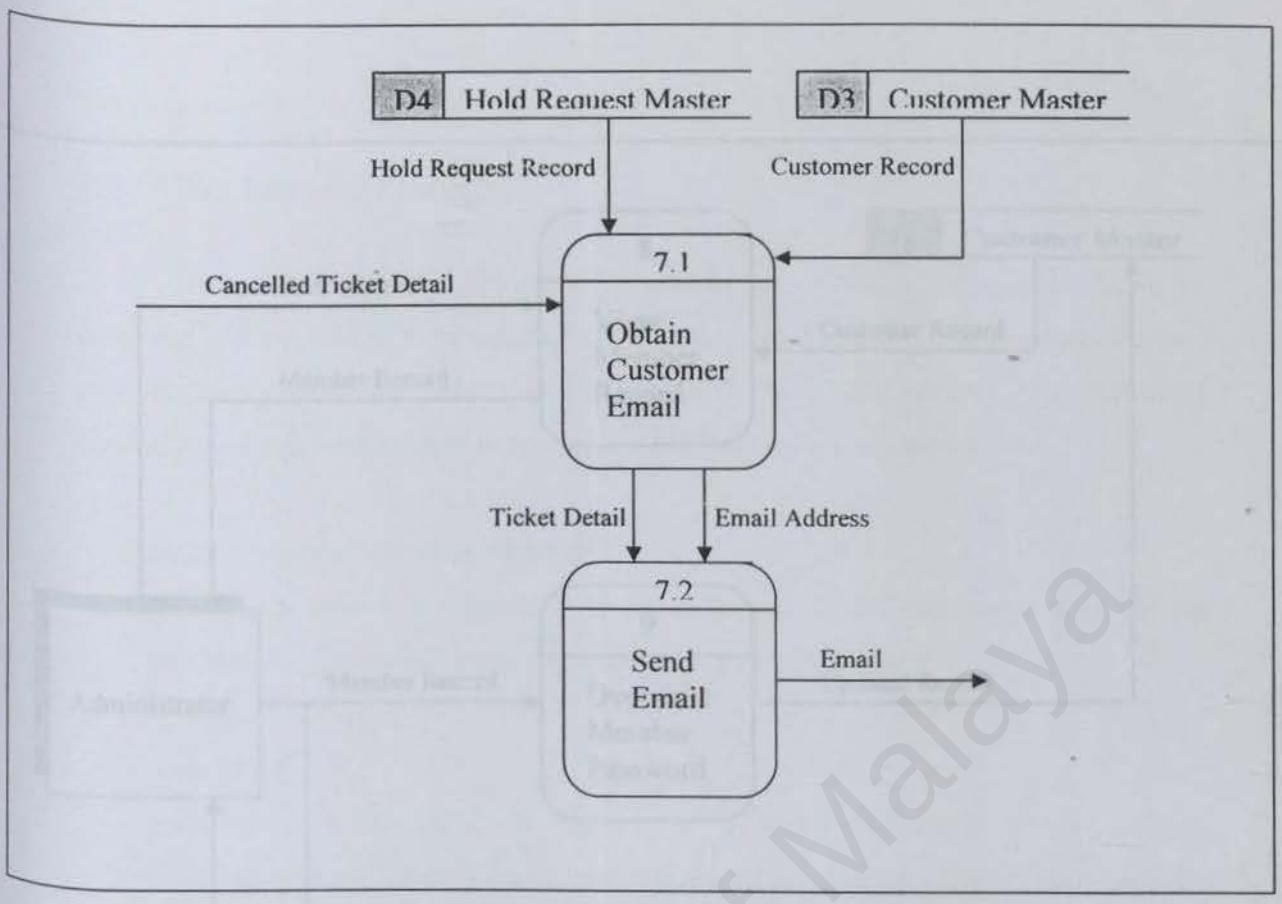


Figure 4.13 Child diagram for Process 7, Generate Email.

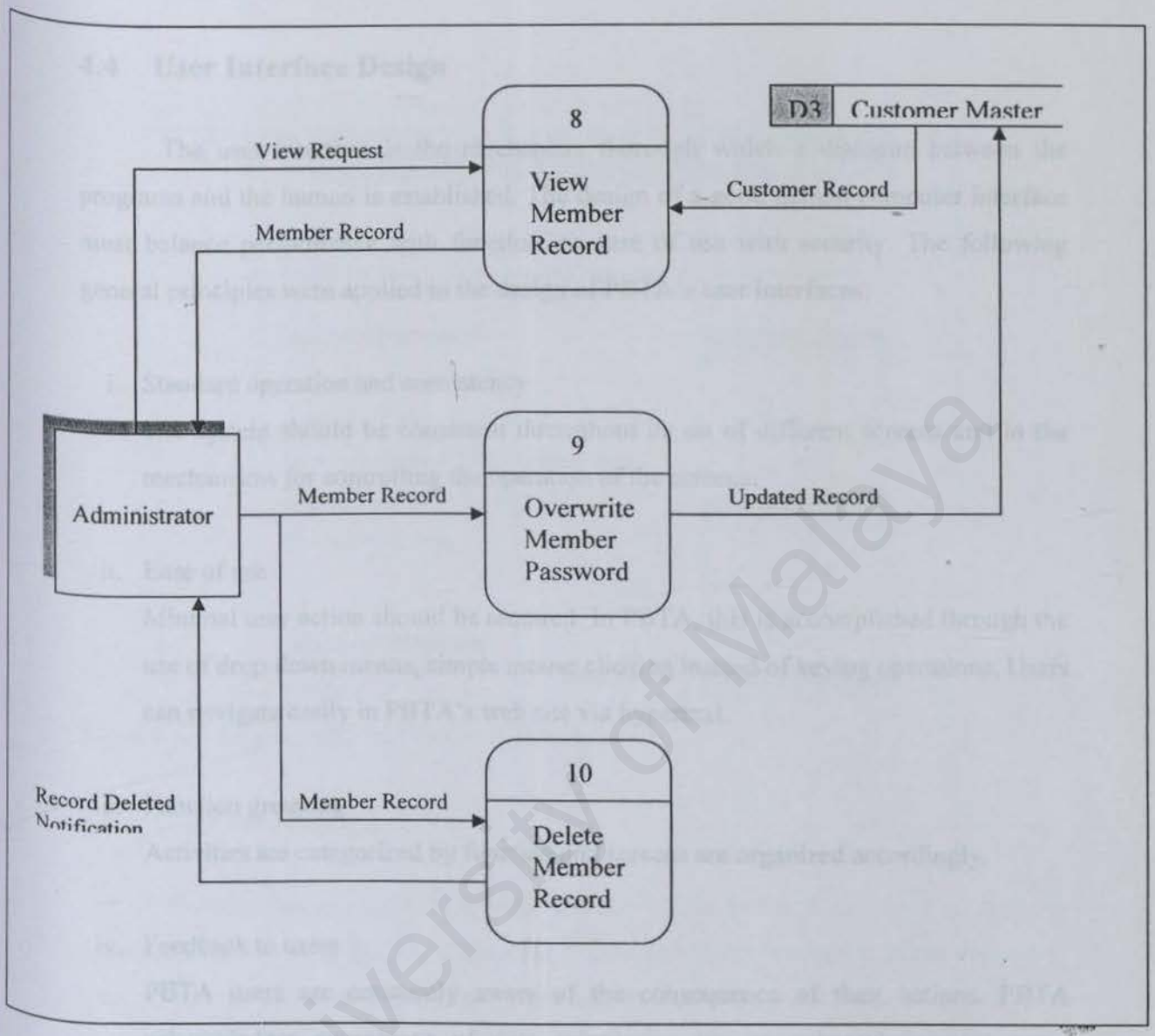


Figure 4.14 DFD for extra processes of Administrator.

4.4 User Interface Design

The user interface is the mechanism thorough which a dialogue between the programs and the human is established. The design of a good human computer interface must balance performance with function, or ease of use with security. The following general principles were applied in the design of PBTA's user interfaces:

i. Standard operation and consistency

The system should be consistent throughout its set of different screens and in the mechanisms for controlling the operation of the screens.

ii. Ease of use

Minimal user action should be required. In PBTA, this is accomplished through the use of drop-down menus, simple mouse clicking instead of keying operations. Users can navigate easily in PBTA's web site via hypertext.

iii. Function grouping

Activities are categorized by function and screens are organized accordingly.

iv. Feedback to users

PBTA users are constantly aware of the consequence of their actions. PBTA acknowledges acceptance of data submission via an acknowledgement page. Meaningful messages are displayed to notify errors.

v. Robustness

The system is able to protect itself from user errors that might cause it to fail. When user enters invalid data, an error page is shown with those invalid data being highlighted. Users are required to re-enter the invalid data before proceed to the next screen.

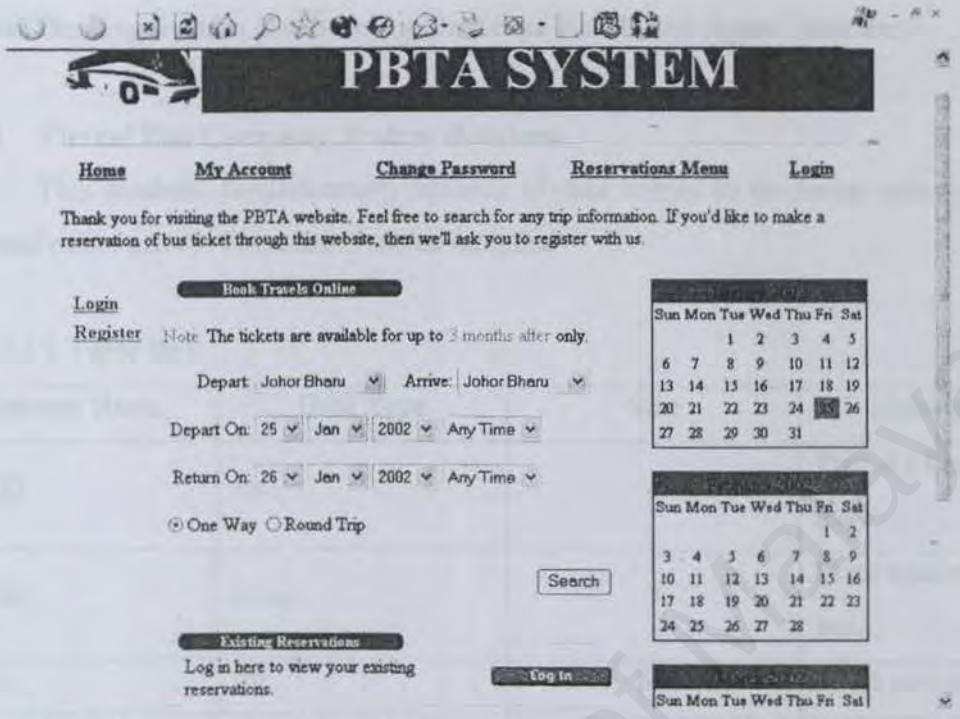


Figure 5.5 Homepage of PBTA System.

4.5 Database Design

The data has to be available when the user wants to use it and must be accurate and consistent. Beyond this, the objectives of database design include efficient storage of data as well as efficient updating and retrieval. It is necessary that information retrieval be purposeful. The information obtained from the stored data must be in a form useful for managing, planning, controlling, or decisions making.

Databases are not merely a collection of files. Instead, a database is a central source of data that meant to be shared by many users for a variety of applications. The heart of a database is the DBMS (database management system), which allows the creation, modification, and updating of the database, the retrieval of data, and the generation of reports.

This project involves three databases – Virtual Bus Company System Database, Virtual Banking System Database and Puduraya Bus Ticket Agent Database.

4.5.1 Virtual Bus Company System Database

This database fundamentally consists of data related to the buses schedule, buses line and ticket prices. There are 5 tables included –

Table 4.2 Table Bus.

Column Name	Data Type	Size	Description
BusID	int	4	Primary Key. ID of bus.
BusNo	nchar	7	Plate number of bus.
Seats	int	4	Total seat number.
Class	char	10	Class of bus.
CompID	int	4	Foreign key. ID of bus company.
Factor	real	4	Factor used in calculating the price of ticket.

Table 4.3 Table Company.

Column Name	Data Type	Size	Description
CompID	int	4	Primary key. ID of bus company.
CompName	nchar	20	Name of bus company.
MerchNo	nchar	16	Merchant account number of bus company.

Table 4.4 Table Ticket.

Column Name	Data Type	Size	Description
TicketID	int	4	Primary key. ID of ticket.
TicketNo	smallint	2	Number of seat.
TicketDetailID	int	4	Foreign key. ID of ticket details.
Status	bit	1	Represent the availability status of ticket.
BRN	nchar	12	Booking reference number assigned to the ticket if the ticket is booked.

Table 4.5 Table Route.

Column Name	Data Type	Size	Description
RouteID	int	4	Primary key. ID of route.
DepartFrom	nchar	20	Departure city.
Destination	nchar	20	Arrival city.
Price	money	8	Price of ticket. Used for calculating the actual ticket price by multiplying with the factor of bus.

Table 4.6 Table TicketDetail.

Column Name	Data Type	Size	Description
TicketDetailID	int	4	Primary key. ID of ticket detail.
RouteID	int	4	Foreign key. ID of route.
DateTime	datetime	8	Date and time of the ticket.
BusID	int	4	Foreign key. ID of bus.

4.5.2 Virtual Banking System Database

Database of VBS contains only the data that can be used for authorization purpose as below:

Table 4.7 Table Cardholder.

Column Name	Data Type	Size	Description
CustID	int	4	Primary key. The unique ID of the customer.
Name	nchar	50	Name of cardholder as displayed on credit card.
CardType	nchar	3	Type of credit card.
CardNo	nchar	19	Credit card number.
ExpireDate	datetime	8	Expired date of credit card.

4.5.3 PBTA System Database

There are 4 tables involved in the PUDURAYA BUS TICKET AGENT System database. These tables are listed as following:

Table 4.8 Table Member.

Column Name	Data Type	Size	Description
Member ID	int	4	Primary key. Unique ID of member.
UserName	nchar	20	User name for member accessing system.
Password	nchar	16	Password of member.
FamilyName	nchar	40	Family name of member.
GivenName	nchar	40	Given name of member.
Gender	nchar	6	Gender of member.
Tel1	nchar	12	First contact number of member.
TelType1	char	1	Type of first contact number.
Tel2	nchar	12	Second contact number of member.
TelType2	char	1	Type of second contact number.
StreetAddr1	nchar	30	Street address of member.
StreetAddr2	nchar	30	
City	nchar	30	City of member.

State	nchar	30	State of member.
Country	nchar	30	Country of member.
ZipCode	nchar	10	Zip codes of member.
Email	nchar	40	E-mail address of member.
Birthday	datetime	8	Birthday of member.
Occupation	nchar	1	Occupation of member.

Table 4.10 Table Reservation.

Column Name	Data Type	Size	Description
ReservID	int	4	Primary key. ID of reservation.
MemberID	int	4	Foreign key. Unique ID of member.
TicketID	int	4	Foreign key. ID of ticket.
BookDate	datetime	8	Date of booking.
BRN	nchar	16	Booking reference number for this reservation.
Notified	bit	1	Represents the notification status.

Table 5.0 Table HoldRecord.

Column Name	Data Type	Size	Description
HoldID	int	4	Primary key. ID of hold record.

MemberID	int	4	Foreign key. ID of member.
Origin	nchar	30	Departure city.
Destine	nchar	30	Arrival city.
Datetime	datetime	8	Date and time for the traveling.

Table 4.11 Table Administrator.

Column Name	Data Type	Size	Description
AdminID	int	4	Primary key. ID of administrator.
Username	nchar	20	User name for administrator to access the system.
Password	nchar	16	Password of administrator.

4.6 Product Expected

It is expected that PBTA System can work properly as one of the online booking system. First at all, PBTA System should play the role of receptionist, which is able to provide all the related information about bus-line found in PUDURAYA to the public. Second, it allows public purchase the ticket using credit card through means of electronic-transaction. Further more, it also offers all the services that are standard for bus company services. For example, customers are permitted to change or cancel their purchases as most bus companies would allow their customers to do so. PBTA System forbid unauthorized persons from access other ones account information by applying a login function, which users must provide correct user name and password to retrieve their records. Another powerful feature of PBTA System is it can automatically inform the members if the ticket cancelled or changed by someone is matched with their hold request. PBTA System is expected to simulate the bus-company daily activities without

any monitoring or controlling by third party. All the ticket selling processes are carried out automatically by the PBTA System and it only need to be maintained periodic by the system administrator.

4.7 Summary

System design is a critical part of development. The user interfaces are designed to evaluate its "look and feel" and are under the possibility of change during coding process. The design method is made in the context that understandable and readable to those who will study or maintain the system. The system design can be changed whenever new features are added to the system or unwanted features are removed.

Chapter 5 System Implementation

In this chapter, we address issues in implementing the design to produce high-quality code. All the system requirements specified and system design proposed in the previous chapters are to be turned into program code to solve the problem. Clearly, there are many ways to implement a design, and many languages and tools are available. Consequently, we would clarify the programming approach used and hardware configuration chosen in implementing the system in the following sections. Besides, some modifications to the previous system design may be made due to weak design that was proposed for the system in previous chapters.

5.1 System Development Environment

The development environment has certain impact on the development of a system. By using the right hardware and software, the progress of system development could be speed up and vice versa. It is also quite important in determining the success of the system. The hardware and software used are discussed as below:

5.1.1 Hardware Configuration

The hardware used to develop this system is listed as below:

- 933 MHz Pentium III processor
- 256 MB RAM
- 52X CD-ROM Drive
- 20 GB Hard Disk
- Other standard desktop PC components

5.1.2 Software Configuration

Many software tools are used for different purposes in developing this system. For example, Microsoft Word is an easy and convenient tool for report writing and documentation. The drawing of data structure and data flow diagram, too, is completed by using drawing tool provided by Microsoft Word. Table 5.1 below depicts briefly the software used in my project:

Table 5.1 Summary of software tools used.

Software	Usage	Description
Microsoft Windows XP	System Requirement	Operating System
Internet Information Server 5.0	System Requirement	Web Server Host
Internet Explorer 6.0	System Requirement	Internet Browser
Microsoft Visual InterDev 6.0	Editor	ASP and HTML Coding
Microsoft SQL Server 7.0	Database	Data storage and manipulation
Microsoft Word	Text Editor	Report Writing and Documentation

5.2 Development Techniques of PBTA System

In this section, we explain the techniques that had been applied in developing PBTA system. It covers the issues such as programming approach, database design, user interface design and etc.

5.2.1 Database Design

A database is a powerful tool that provides many advantages over traditional programming and hierarchical files. But, these advantages could only be reached if the database had been correctly designed. Typically, database is a collection of tables. As a result, the data normalization is a very important process of creating a well-behaved set

of tables to efficiently store data, minimize redundancy, and ensure data integrity. In this project, we have tried all our best to ensure each table that we created were in third normal form (3NF), which are enough already to reduce the redundancy of data storage and achieve good database design. Besides, the database is flexible enough to handle the future needs such as it could evolve as the system grows.

5.2.2 User Interface Design

User interface presents the look and feel of the application as it is seen by the users. The graphical user interface is employed in this system so that the users can perform the tasks easily and directly without remembering any commands. The interfaces are consistent throughout the whole system to avoid any confusion. Moreover, certain colors and font styles are used to increase the attractiveness of the system. In conclusion, the PBTA System's user interfaces are carefully designed by applying the concepts and rules that fulfills the multimedia principles.

5.2.3 System Design and Development

5.2.3.1 Top-down Approach

In this project, we applied the top-down approach for our system design. In a nutshell, a top-down approach means looking at the large picture of the system and exploding it into smaller parts or subsystems. The advantages of using a top-down approach to system design include avoiding the chaos of attempting to design a system "all at once". It also prevents one from getting mired in detail and losing sight of what the system is supposed to do. Inevitably, there are some pitfalls of top-down design that need to be aware of. First, the system could be probably divided into the wrong subsystems. It is important that each subsystem address the correct problem. Second, once subsystem divisions are made, their interfaces may be neglected or ignored. Responsibility for interfaces needs to be detailed. Third and last, subsystems must be integrated eventually. So, mechanisms for reintegration need to be put in place at the beginning.

5.2.3.2 Modular Development

Once the top-down approach is taken, the modular approach is useful in programming. This approach involves breaking the programming into logical, manageable portions or modules. Ideally, each individual module should be functionally cohesive, so that it is charged with accomplishing only one function. Modular program design has three main advantages. First, modules are easier to write and debug because they are virtually self-contained. Tracing an error in a module is less complicated, since a problem in one module should not cause problems in others. A second advantage of modular design is that modules are easier to maintain. Modifications usually will be limited to a few modules and will not spread over an entire program. A third advantage of modular design is that modules are easier to grasp, since they are self-contained subsystems.

5.3 Security Features

We have applied some simple security features for PBTA System in order to protect the users' right and increase users' confidence in using this system. All the important functions such as cancel the existing reservations, update the profile and view existing reservations would require identity validation. This function is achieved by using the session variable of ASP. This should be secure enough because the session variable can only be set through the method provided by us. Even the public can type in exactly the URL such as for processing the reservation cancellation, but without login through the login function provided, the session variable "blnValidUser" would still indicate that this user haven't logon. Thus the system will redirect them to the PBTA System's homepage.

5.4 Types of Users

PBTA System consists of two different categories of users that are normal users and administrator respectively. Normal users are the public that access this system through the Internet. Of course, the public can sign up as the members of PBTA System to benefit from many of convenience given by it. Contrast, administrator is the sole

person that can carry out the administration work for this system. The administrator is assigned at the beginning of system setup.

5.5 Types of Services Offered

PBTA System has offered a lot of useful and powerful functions for its members or the public. First and foremost, it allows the public to search for the available bus tickets which provided by long-distance bus companies in Peninsular Malaysia. For the members of PBTA System, they can book the tickets online using credit card. Besides, they can view their reservations as well anytime and anywhere through the Internet. They can also cancel their reservations if they intended. To sum up, PBTA System has successfully brought the services that provided by long-distance bus companies into the Internet.

5.6 Data Validity Checking

Since all the data of PBTA System are stored in SQL Database, so the data validity and integrity checking is very important because incompatible or missing data would causes system failure and even catastrophe. PBTA System has carried out a lot of data validation and checking before the information inputted by users is stored into the database. For example, during the registration process, ones must input all the required data before the registration form can be submitted. The system will prompt the corresponding error messages when one has missed out the important input or keyed in the wrong data. The system also verifies some input like zip code must contains only numeric data. Another significant data that need to be paid attention is the date format data, since there are many of different date formats exist depending on the users' nationality and culture. In order to simplify the checking procedure, the date format data has been hard-coded by using the drop-down list to allow users choose from it. All the validation checking should assure the consistency and correctness of data that are manipulated by the system.

5.7 Summary

Implementation of system is a process to convert the system requirements into program and ensure it is feasible or practical. After that, the new system is ready to be tested. The next chapter will elaborate the testing procedures.

Chapter 6 System Testing

It is necessary for us to carry out a thorough testing on all of the system's newly written or modified application programs. The main purpose of testing is to find out any faults or errors that exist in our programs. The testing process does not only assure the quality of our system but also ensures that our system satisfies its requirement specification and users' expectations. In this chapter, we describe briefly the types of tests that we have done for the PBTA System.

6.1 Testing Process

As stated in Chapter 5, the PBTA System comprises of modules which perform certain functions independently. Therefore it is more efficient and easier to perform the testing with several stages. Each testing stage is explained as below:

6.1.1 Unit Testing

Each program component is tested on its own, isolated from the other components in the system. Such testing is known as module testing, component testing or unit testing, which verifies that the component functions properly. The following categories of test data have been used in performing this testing:

- *Normal data* – to test a given correct data will produce the expected results.
- *Erroneous data* – for a given erroneous data, like invalid date format, can the system detect it?

- *Boundaries value analysis* – data that are out of the range specified will be used to test the system because errors may occur at extreme points.
- *Condition testing data* – some functions may be active under certain conditions, therefore a set of data are tested on all possible conditions.

The following steps specify how unit testing is carried out for this system:

- The code of the program is examined by reading through it to spot algorithmic faults and syntax faults.
- All command buttons, text boxes and other control objects are tested to check its functionality.
- Different types of test data are used like number, character, date and etc. to test all the control objects.
- Test cases are developed to ensure that the input is properly converted to the desired output.

The unit testing has been carried out for the search function, book function, display booking result function, cancel reservation function, hold request function and display existing reservation function respectively. Each suitable categories of data specified above are used to test each function. For example, in order to confirm the search function working properly, first we try to input the information that should yield successful search result. Then we inspect the search result are correct by make sure the ticket details shown are same as the data we stored in the database. After that, we advance to unsuccessful search that with the given information, the search function should return no tickets have been found. During this testing process, some queer results

have been detected which the search function work properly for certain data only. Finally, the fault has been determined that the SQL statements were incorrect where the conditions are wrongly specified and had been successfully corrected. In conclusion, each function is verified function properly by inspecting the results yielded with all the possible data provided is as desired. During unit testing, majority of faults have been found are caused by the syntax errors, incompatible data format or algorithmic errors.

6.1.2 Integration Testing

The search function, book function, display existing reservation function, hold request function and cancel reservation function should work collaboratively as a whole user module. The integration testing is performed to ensure the system achieves this goal. For example, the integration testing is done by first perform the cancel reservation function, then the display existing reservation function is verified function correctly by inspecting the reservations which have been cancelled just now are not displayed. Similarly, after reservation function is called then it should affect the search function where the tickets that have been booked should not be returned in the search result again.

At the same time, some functions of administration module depend on the functions of user module. Each time the reservation function or hold request function of user module is called, the record should be reflected in the hold request maintenance and reservation maintenance of administration module respectively. Testing has been performed by carry out the reservation function and hold request function followed by the hold request maintenance and reservation maintenance consecutively, and the result is

inspected to ensure it produces the desired output. Some errors have been found such as when the tickets have been cancelled by the users, the search function does not return the corresponding tickets for the following search. The error has been determined that the database is not updated properly where the status of tickets haven't been resetted when the tickets are cancelled and had been successfully corrected.

6.1.3 System Testing

Finally, system testing is performed to ensure that the system fulfills user requirements. The system testing involves function testing and performance testing that described as below:

6.1.3.1 Function Testing

Once we are sure that information is passed among components in accordance with the design, we test the system to assure that it has the desired functionality. A function test evaluates the system to determine if the functions described by the requirement specification are actually performed by the integrated system. The result is a functioning system.

Function testing is done by carry out every function provided from user module and administration module. For example, we try to book the ticket step by step which first we search the desired tickets, next we register as member or login the system, and last we book the tickets. Then, we try to view the reservation that just made and cancel the reservation to make sure the system perform all the functions as we like. The major

fault that has been found in the system testing is some links have caused little flaws in this system. For example, the users have been redirected to homepage after they have successfully login or registered during the reservation process. Thus, they are forced to search the same tickets again to complete their reservations. This flaw has been eliminated by create a additional variable as the indicator, so as the users are redirected to right web page after they have successfully login or registered.

6.1.3.2 Performance Testing

Performance testing addresses the non-functional requirements of the system. The types of performance tests done for PBTA System are:

- Security test – to ensure the system fulfills the security requirement.
- Timing test – to ensure the response time of the system is acceptable.
- Human factor test – simple forms and displays related message to determine user friendliness.
- Volume test – to ensure all the fields can accommodate the expected data.

In performance testing, each input field provided and script written are tested. For example, we intentionally select the invalid date to make sure the corresponding error message is prompted. Moreover, we try to ensure each page is loaded in the acceptable amount of time. If the page is loaded too slowly, then we try to inspect our program's source code in order to improve our coding. Majority of faults found in the performance testing is syntax errors in JavaScript and had been successfully corrected.

6.2 Summary

In this chapter, we discussed many major issues involve in system testing. After variety of tests are conducted, a lot of errors or faults are eliminated from PBTA System meanwhile the system's reliability, availability and maintainability are highly improved.

Chapter 7
System Evaluation and Conclusion

Every newly developed system needs to evaluate to its strengths and limitations or constraints. Such evaluation will provide feasible information for future enhancements. It also highlights the knowledge obtained and identifies problems encountered in the system development and steps to be taken in solving problems.

7.1 System Strength

The strength of PBTA System is discussed as below:

- **Security**

  PBTA System provides a login function for both User Module and Administrator Module. This login function is used to protect the users' and administrator's privilege. For example, only authorized users with valid user name and password are allowed to view their existing reservations, cancel the reservations, view or update the profile detail. Similarly, the administrator must type in the correct password before he or she can perform the administration tasks.

- **Round trip search**

  PBTA System provides a round trip search option for the users. Generally, most users would like to go back to the place where they depart from. If the users check the round-trip box, then the search will also be performed for the tickets that depart from the arrival city and arrive at the origin city on the date specified by

the return date, otherwise the return date is simply ignored by the search function. Depending on the search result, the users can make the reservations for any tickets that are available.

- **E-mail notification**

  There is e-mail notification function in the Administration Module. This function can be used by an administrator to easily notify members for each ticket reserved. The function is shown as the hyperlink that when clicked will pop-up the system's default e-mail server such as Microsoft Outlook and fill in automatically the user's e-mail address.

- **Automatic calculation**

  The users need not calculate the total price of the tickets. Instead, the total price of the tickets is calculated automatically by the system.

- **Hold function**

  There is a hold request function available if the search result shows that there are no tickets available that matches the users' requests. The users use hold request when they would like to receive the e-mail notification for certain tickets that are currently not available. The hold request function is intelligent that it would check first whether the users have held the request already before this function is provided, thus the users never hold the same request repeatedly and thus save the database storage space.

- **Simple and user-friendly interface**

  The user interface of the system is quite user-friendly and consistent from one interface to another. The flow of the system is very easy to follow and users do not have to follow any complex procedure in performing certain function. All the functions can be performed easily by just clicking a button and filling the require information.

- **Fast response**

  Each web page is design to be lightweight. These pages are loaded in a reasonably short time to ensure a fast view of the pages where heavy graphics have been avoided.

- **Incorporates data validation**

  Data validation is carried out before the form is submitted by users. All fields in the form will be checked for null value or invalid data type. With this feature, the error of inserting record into the database can be avoided. Error message will also prompt the users if important fields are not filled.

- **System Transparency**

  System transparency refers to the condition where the users do not need to know where the database resides, how the system is structured, its database management system and anything related to the system built. This feature is very important to avoid confusion that could lead to destruction of important data.

- **Consistency**

  PBTA System maintains the consistency of screen design, layout, structure and links.

7.2 System Limitations

Despite of the system strengths mentioned above, there are a few limitations due to time and various constraints. The limitations are:

- **No Traveler Preferences**

  The users are unable to select their preferences like which class of bus or company they intended to search, the location of seats when they want to make the reservation and etc.

- **No Online Payment Transaction**

  Even though the system includes the procedure of credit card holder authentification, it dose not process the transaction that transfers the payment from or into the users' and merchants' accounts.

- **No Online Help Facility**

  PBTA System does not provide any online help. The users who require more information may not be satisfied with the brief instructions and descriptions available. It should be rectified in the future.

- **No Automatic E-mail Notification**

  Although previous system design have specified that PBTA System is able to generate an e-mail automatically whenever that is reservation done or cancellation made, such services can only be achieved by using the Windows 2000 Server edition. Consequently, this function is regressed by providing a hyperlink that invokes an e-mail server and requires the administrator to type the content and send the e-mail manually.

7.3 Future Enhancements

During the development of PBTA system, there are some new ideas have crossed our mind. However, due to the time constraint, not all of these ideas could be realized. Some of the ideas are as follows:

- **Improve Search Function**

  The search function can be improved by providing more options for the users. For example, users should be given the opportunity to specify what company and class of bus they prefer. Besides, they can also specify how many tickets they want at the beginning, so the search function will only return the result for those buses that have enough tickets.

- **Include Traveler Preferences**

  The users should be able to see what seats are available and make a selection. The available seats can even be displayed with graphical user interface so the users will be more comfortable and clear in choosing their preferred seats.

- **Provide Automatic E-mail Notification**

  The e-mail notifications normally contain the similar contents with corresponding tickets' detail. The PBTA System should be able to automatically generate the e-mail, so as to save a lot of administrator's work and time in sending the e-mail manually.

7.4 Problems Encountered and Solutions

There are many problems encountered during the development of this project. They are described as below.

7.4.1 Software Selection

Web-based application is the new technology that has been promoted for the last few years. Due to the rapid development of this type of application, there are many technologies emerging in the market such as ASP, ColdFusion and CGI. Without knowledge the development of these technologies, it is difficult in select the appropriate software.

To handle this problem, a study has been done on the web technology, programming language, operating system, web server and development tools to find out the features and capabilities of them. All studies are carried out through reading from books, magazines, journal paper and net surfing. Advice is also sought out from course mates and lectures.

7.4.2 Zero Knowledge of ASP and Windows 2000

Installation of the Windows 2000 causes some difficulty because there is some configuration on Windows 2000 that is very different from Windows 98. Besides, ASP is

a new technology used to develop web-based application. The lack of knowledge of ASP has increased the learning curve in this project development process.

We have set much time for reading the book of title Beginning ASP. Other materials are also retrieved from the Internet to speed up the learning of ASP. Advice from the course mates is very helpful in the learning process.

7.4.3 No Exposure to Database Server

The development of this project involves the use of database due to the vast amount space needed to store the tickets and members data. This also increases the project learning curve due to my ignorance of the Microsoft SQL Server. So there is need to do research on how to set up a database.

Study on the online help provided by the Microsoft SQL Server 7.0. Some online tutorials that teach how to design and manage SQL Server are also taken as additional references.

7.5 Summary

Finally, this project has been successfully completed in time and fulfilled most of the objectives and requirements as determined during system analysis phase. The system was found to be user friendly, easily understood, and effective. It allows the users to access from anywhere and at anytime through the Internet. However, some minor limitations still exist in the system. The limitations should be eliminated in future enhancements and maintenance to produce more powerful and useful system.

Throughout this project, much knowledge and experience were gained. For example, we have gained skills such as programming in HTML, ASP, VBScript and so on that are very valuable and benefit for all our life. This project also provides the golden chance to us to practice the techniques, paradigms, and approaches learned from System Analysis & Design and Software Engineering courses. Lastly, the research that we have done provides us the up-to-date knowledge and information that keeps us up with the fast and ever changing information technology age.

Appendix

User Manual

1.1 Introduction

PBTA System is an online system developed for the visitors to make a reservation of long-distance bus tickets through Internet. This system saves a lot of time and simplifies the trivia procedure for the public to buy the bus tickets or inquire information from the long-distance bus companies. The visitors can also use this system to cancel their existing reservations where fixed charge will be imposed. PBTA system is expected to converts the traditional way of bus companies conduct their business into the more sophisticated electronic way that has became the trend nowadays.

1.2 System Requirements

The following tables describe the minimum requirements for using PBTA System in server side and client side respectively.

Table 1 Summary of minimum requirements for Client Side.

Requirements	**Description**
Windows 95/98/ME/NT/2000/XP	Operating System
Internet Explorer 4.0 or above	Web Browser
Pentium 486 or higher processor Minimum 32 MB RAM Modem and telephone line or other compatible devices for accessing the Internet VGA monitor (Supports 800 x 600 resolution) Other computer-compatible accessories. (Keyboard, mouse, speaker, etc.)	Hardware requirements

Table 2 Summary of minimum requirements for Server Side.

Requirements	**Description**
Windows 2000/XP (with IIS 5.0 installed)	Operating System
Internet Explorer 4.0 or above	Web Browser
Microsoft SQL Server 7.0	Database Server
Pentium III 500 MHz or higher processor Minimum 128 MB RAM 5 GB hardisk or above VGA monitor (Supports 800 x 600 resolution) Windows 2000-compatible network adapter card and related cable Other computer-compatible accessories. (Keyboard, mouse, speaker, etc.)	Hardware requirements

1.3 System Setup

First step is to run the PBTA.sql, Bank.sql and Bus.sql in the folder "SQL Scripts". To run these scripts, you need to open the Enterprise Manager of SQL Server 7.0 and create three new databases, each one with name PBTA, Bus Company and Bank respectively. Then you can open the Query Analyzer of SQL Server 7.0, select the corresponding database, open and run the corresponding script. After complete this step, all the required tables are inserted into the right databases. However, all the tables are empty and you need to input manually all the required data especially for Bus Company Database, otherwise the search result will always return no tickets are found. And you also need to put in some records into the CardHolder table of Bank Database that used for verification during the reservation process. For CardHolder table, the important fields which need to be paid attention are CardType and ExpiredDate. We represent the CardType as following:

i. AE: American Express
ii. MC: MasterCard
iii. V: Visa

Meanwhile, if the ExpiredDate in the database is "4/1/2002" (mm/dd/yyyy), it means this card's expire date is on March 2002 and is valid by April 2002. The PBTA System database requires no data at the beginning, all the data will be inserted when the users sign up as member, make a reservation and cancel the reservation.

The following step is to create a virtual directory for the folders "PBTA" and "Administration" provided and make some change for the files "PBTA_Conn.asp", "BusCompany_Conn.asp" and "Bank_Conn.asp". The way to create a virtual directory is explained in any books about ASP. The following uses "PBTA_Conn.asp" as example to demonstrate the changes that need to be made:

1. <!-- METADATA TYPE="TYPELIB"
FILE="**C:\Program Files\Common Files\System\ado**\msado15.dll" -->"

To

<!-- METADATE TYPE="TYPELIB"
FILE="**YourSystemDirectory**\msado15.dll" -->

2. objConnPBTA.Open "Provider=SQLOLEDB.1;User ID=sa;Persist Security Info=False;" & _
"Initial Catalog=PBTA;**Data Source=KUANG;**" & _
"Initial File Name=C:\SQL Data\PBTA_Data.MDF"

To

objConnPBTA.Open "Provider=SQLOLEDB.1;User ID=sa;Persist Security Info=False;" & _
"Initial Catalog=PBTA;**Data Source=YourServerName;**" & _
"Initial File Name=YourSystemDirectory\PBTA_Data.MDF"

Please note that we use the blank password for the database administrator with user id "sa", so if the error such as fail to connect to your database occurred, then you may need to include the sentence "Password=YourPassword" into the statement above.

2.1 Users Module.

2.1.1 Homepage of PBTA

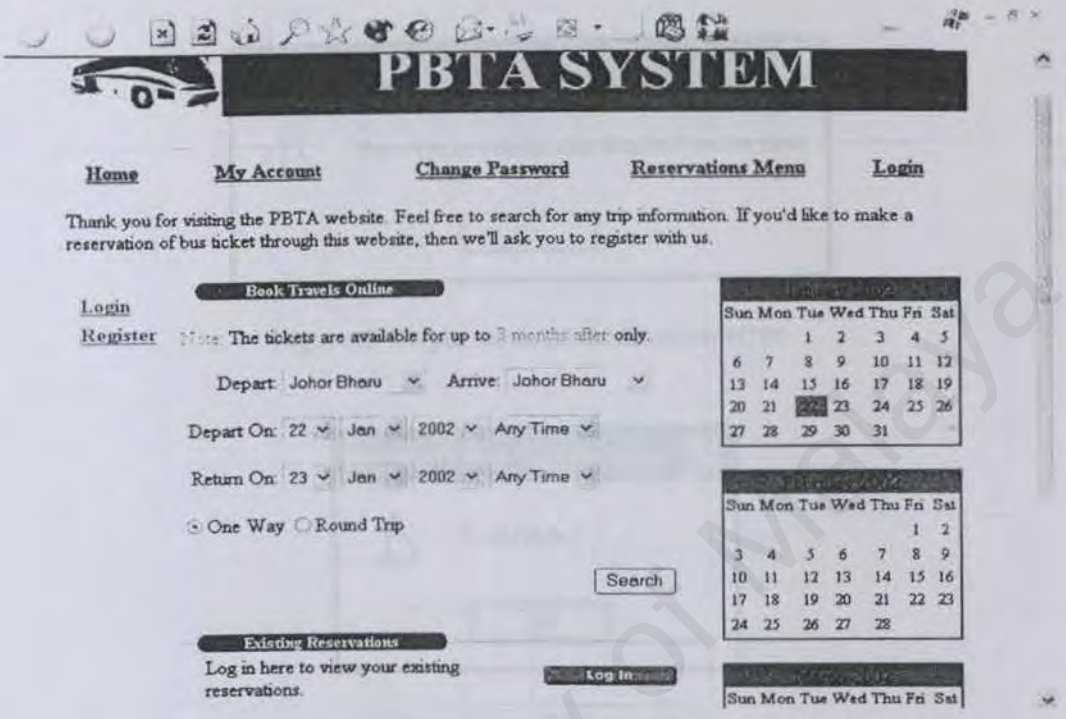


Figure 1 Homepage of PBTA System.

Figure 1 presents the main page of PBTA System. There are five consistent and static links that will be displayed on each page of this system. These five hyperlinks are self-explained, that "Home" links to main page as above, "My Account" links to the page allows users to edit their profile, "Change Password" links to the page allows users to change their password, "Reservation Menu" links to page displays users existing reservation, and "Login" links to page allows the users to login but this link is changed to "Logout" after users login successfully.

1. Type in the URL: http://yourServerName/pbta
2. You can login to the system, register as member, change your password, view your existing reservations, or start a search.

Before the search request is submitted, this system will carry out some validation for the data inputted by the users. If the data is invalid, then the corresponding error

message is prompted and the invalid field is highlighted. The following displays the possible error messages that users may encountered when using the search function of this system:

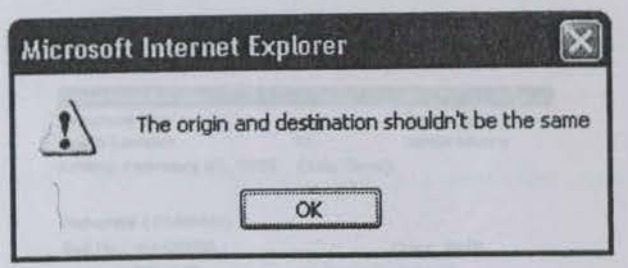


Figure 2 Origin same as destination error.

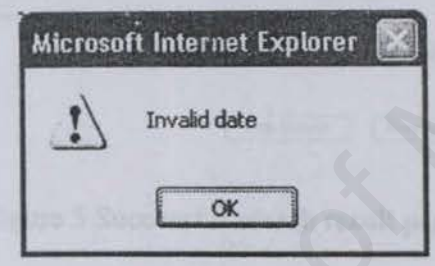


Figure 3 Invalid date error.

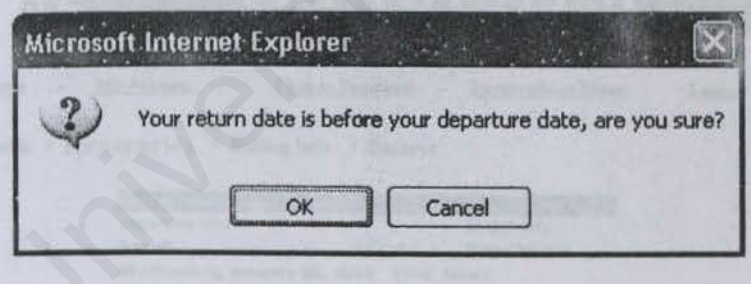


Figure 4 Return earlier than departure error.

2.1.2 Search Result page

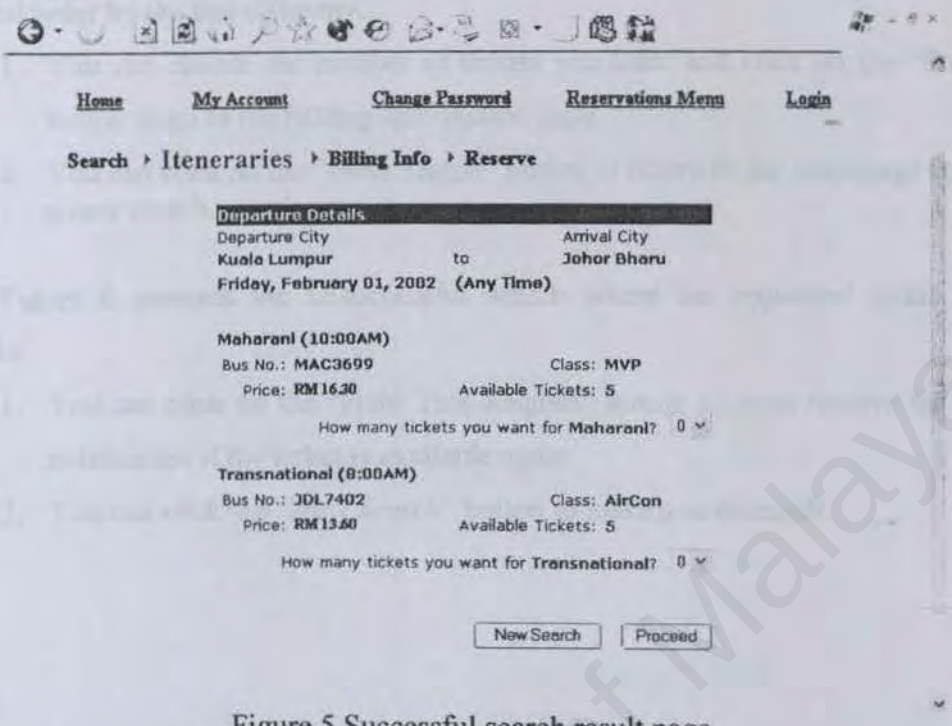


Figure 5 Successful search result page.

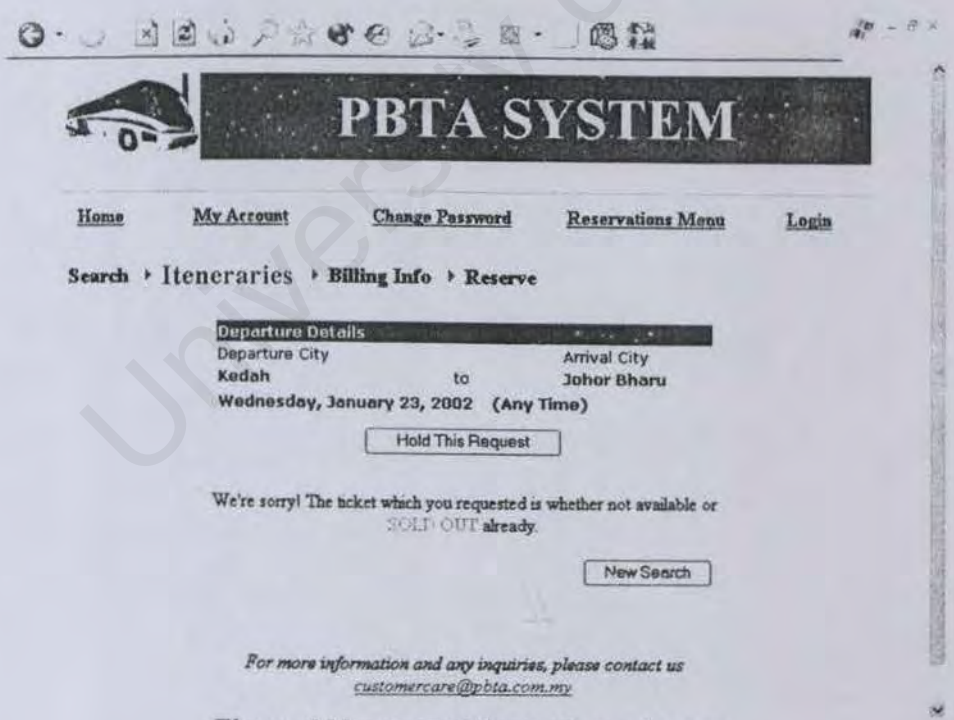


Figure 6 Unsuccessful search result page.

Figure 5 presents the successful search where all the available tickets are displayed order by the bus company.

1. You can choose the number of tickets you want and click on the "Proceed" button to go to the Billing Information page.
2. You can click on the "New Search" button to return to the homepage and start a new search.

Figure 6 presents the unsuccessful search where the requested ticket is not available.

1. You can click on the "Hold This Request" button so as to receive the e-mail notification if the ticket is available again.
2. You can click the "New Search" button to make a new search.

2.1.3 Billing Information page.

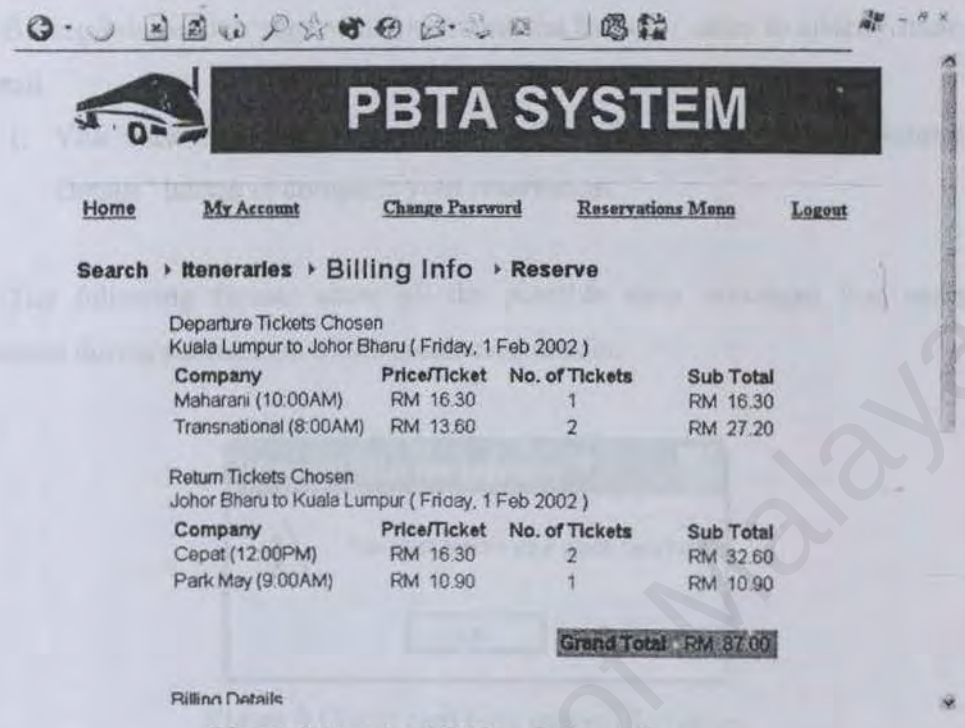


Figure 7 Part 1 of Billing Information page.

Figure 8 Part 2 of Billing Information page.

Figure 7 presents first part of the Billing Information page which displays the billing details about the tickets that users have chosen. Figure 8 presents the second part of this Billing Information page which contains the form for users to specify their credit card detail.

1. You must fill in all the required information and click the "Submit Card Details" button to complete your reservation.

The following figures show all the possible error messages that users may encountered during submission of the credit card details.

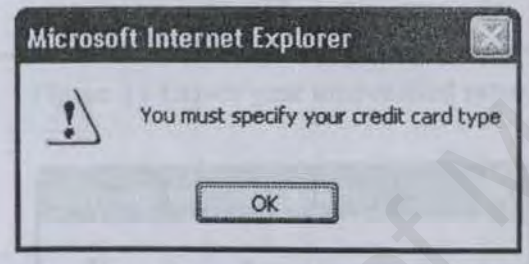


Figure 9 Credit card type unspecified error.

Figure 10 Name missing out error.

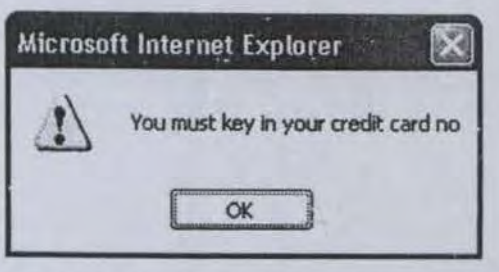


Figure 11 Credit card numbers missing out error.

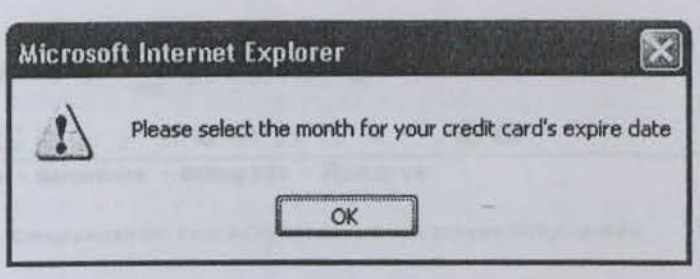


Figure 12 Expire month unspecified error.

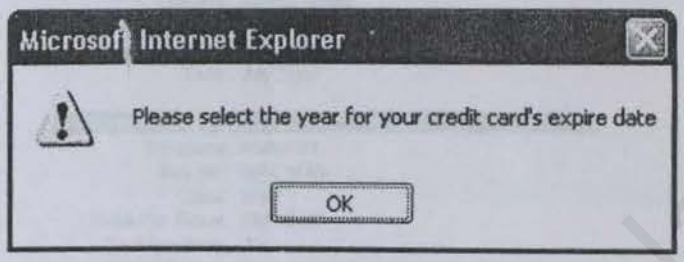


Figure 13 Expire year unspecified error.

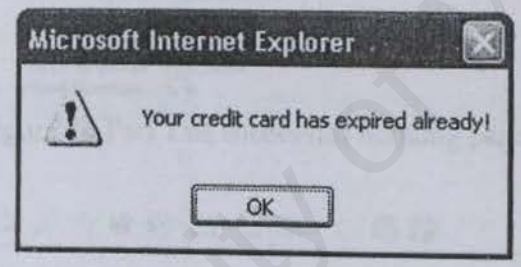


Figure 14 Credit card expired error.

2.1.4 Reservation Completed page.

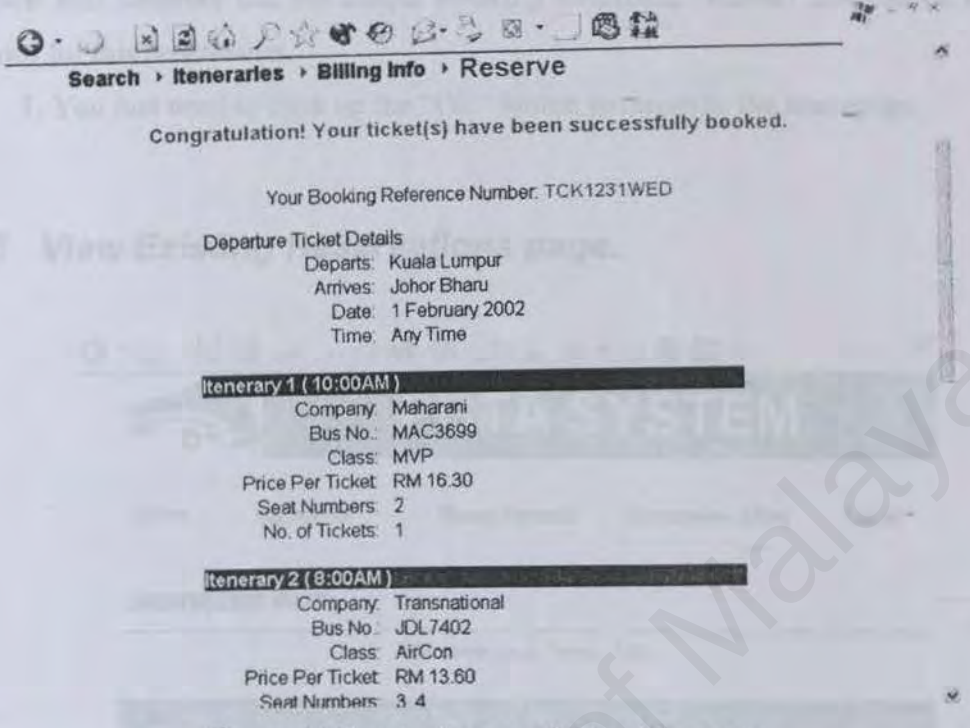


Figure 14 Part 1 of successful booking page.

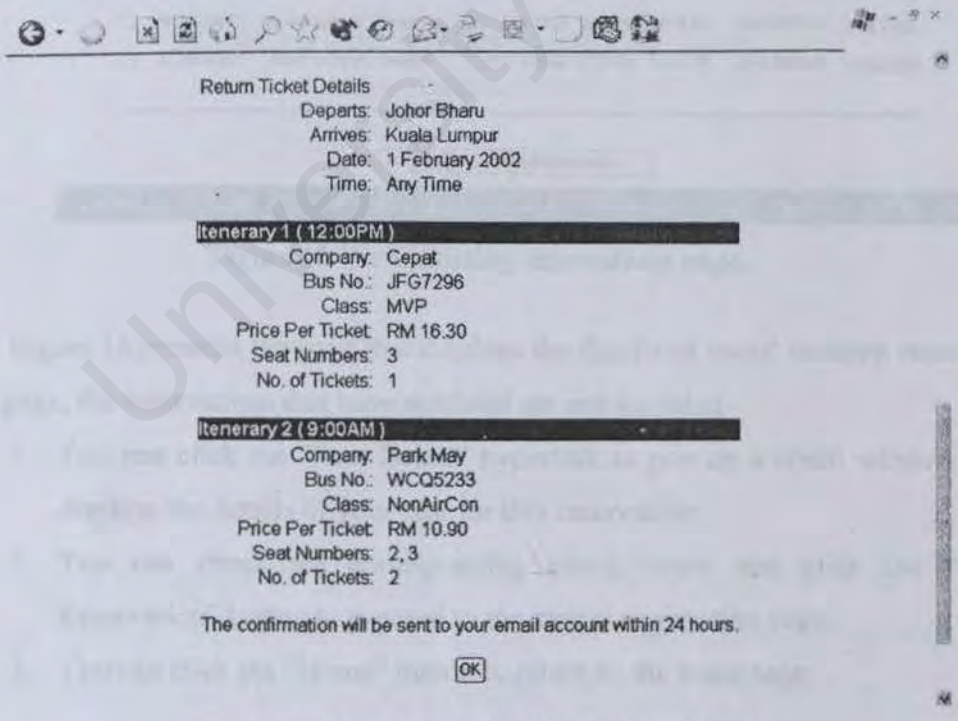


Figure 15 Part 2 of successful booking page.

Figure 14 and Figure 15 display the booking details. In this page, the users can find their seat numbers and the unique Booking Reference Number that can be used as the proof for this reservation.

1. You just need to click on the "OK" button to return to the homepage.

2.1.5 View Existing Reservations page.

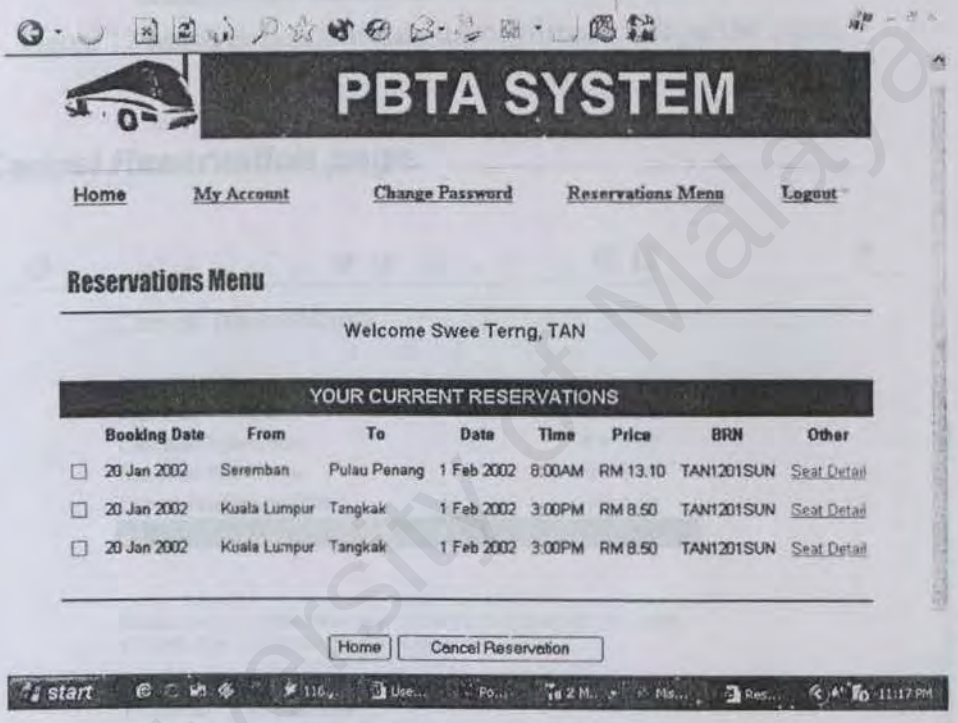


Figure 16 View existing reservations page.

Figure 16 presents the page that displays the details of users' existing reservation. In this page, the reservations that have outdated are not included.

1. You can click the "Seat Detail" hyperlink to pop up a small window which displays the details of your seat for this reservation.
2. You can check the corresponding check boxes and click the "Cancel Reservation" button to proceed to the cancel reservation page.
3. You can click the "Home" button to return to the homepage.

To avoid accidentally cancel the reservations, the system will get a confirmation first from the users before proceed to the cancellation page.

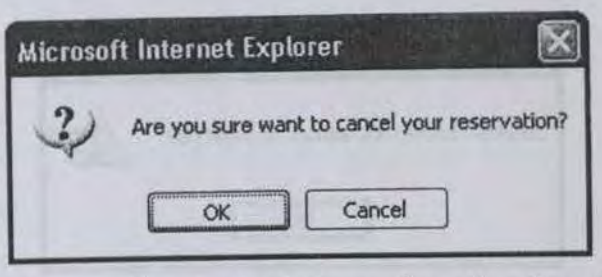


Figure 17 Message box to obtain the confirmation from the users.

2.1.6 Cancel Reservation page.

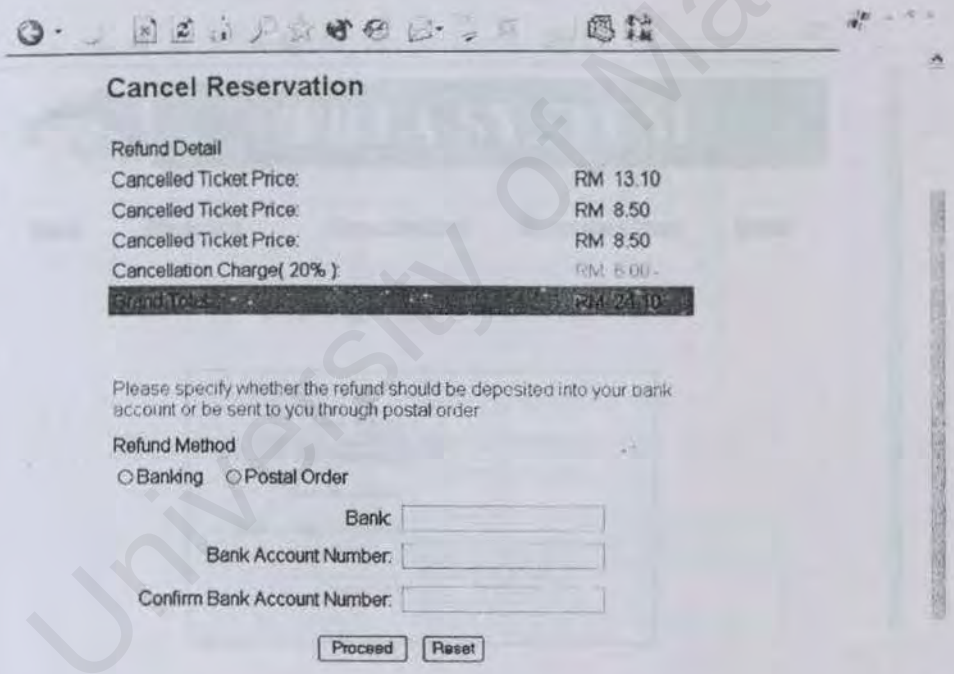


Figure 18 Cancel reservation page.

Figure 18 displays the refund detail about the cancellation. The three input fields below are editable only if the "Banking" checkbox is checked. The error message is pop-up if the users click the "Proceed" button without specify the refund method.

1. You need to specify the refund method and click the "Proceed" button to complete your cancellation procedure.

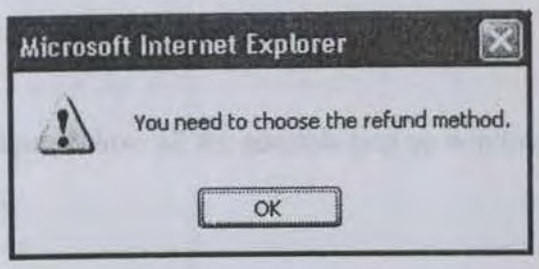


Figure 19 Refund method unspecified error.

2.1.7 Changing Password page.

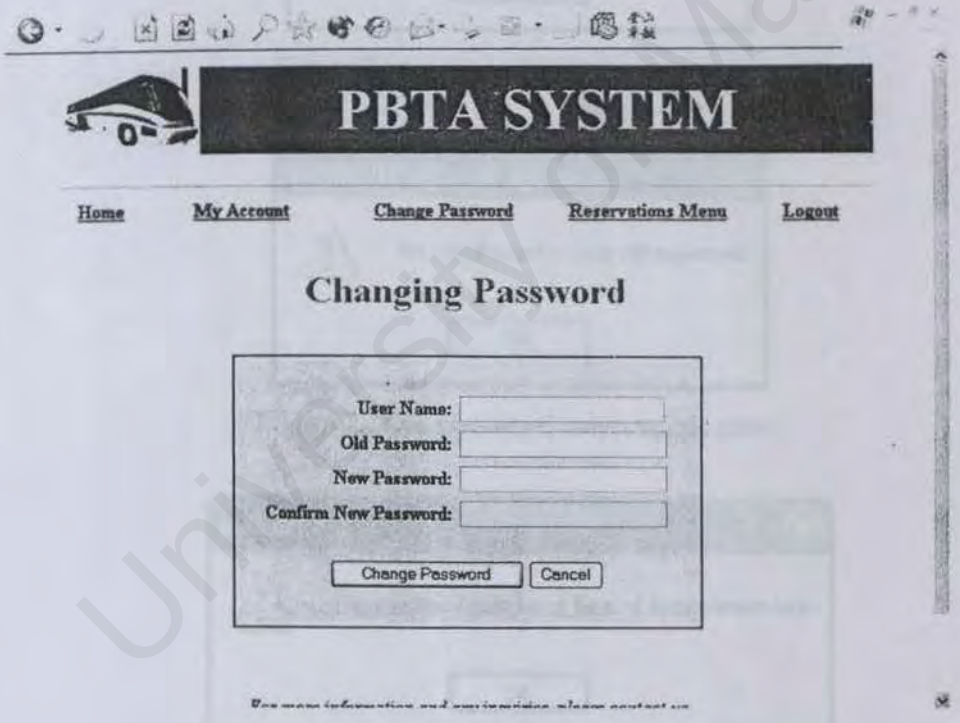


Figure 20 Changing password page.

Figure 20 presents the page that allows users to change their passwords. The data validation is performed before this request is processed. The users are redirected to homepage after successfully change their passwords.

1. You can key in all the required inputs and click the "Change Password" button to change your password.
2. You can press the "Cancel" button to return to the homepage without changing your current password.

The following figures show all the possible pop up windows that can be encountered in this page.

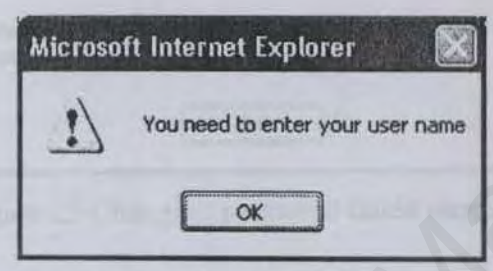


Figure 21 User name missing out error.

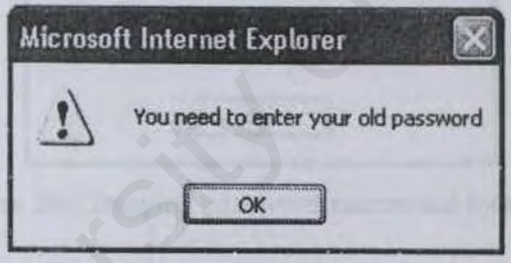


Figure 22 Old password missing out error.

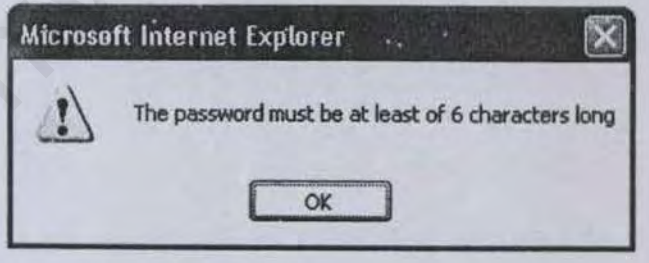


Figure 23 Invalid new password error.

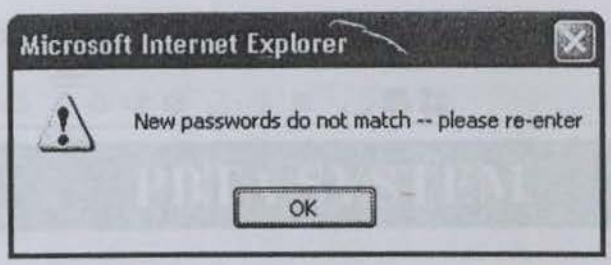


Figure 24 New passwords don't match error.

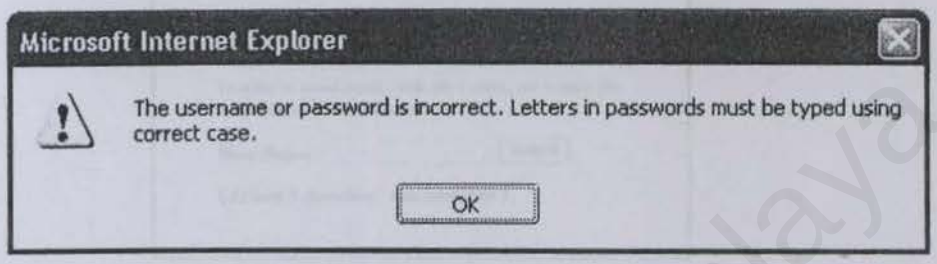


Figure 25 Changing password failed message.

Figure 26 Changing password succeeded message.

2.1.8 Registration page.

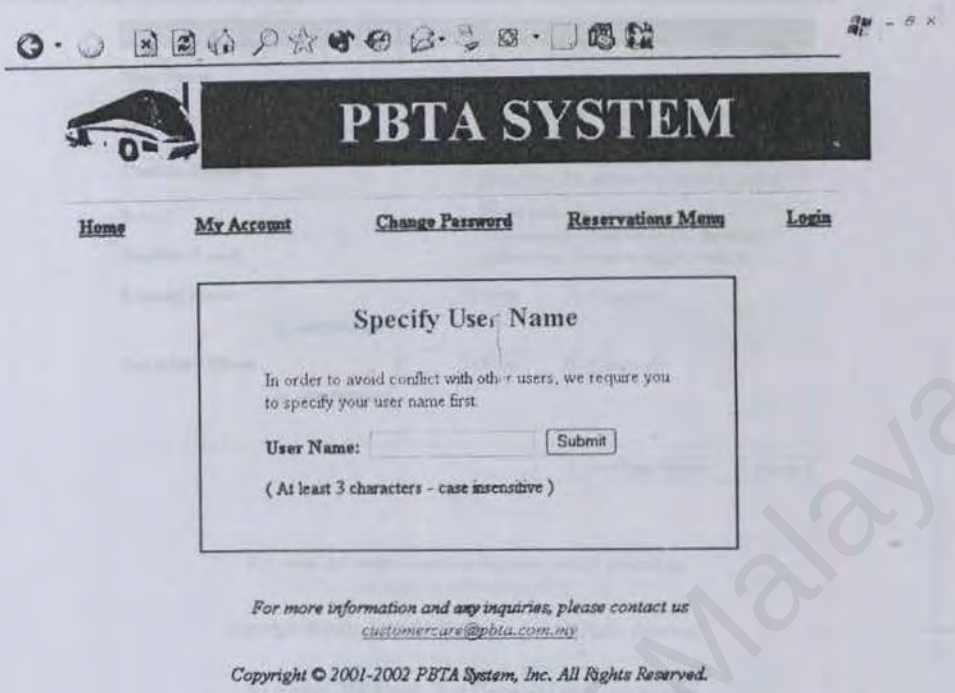


Figure 27 Specify user name page.

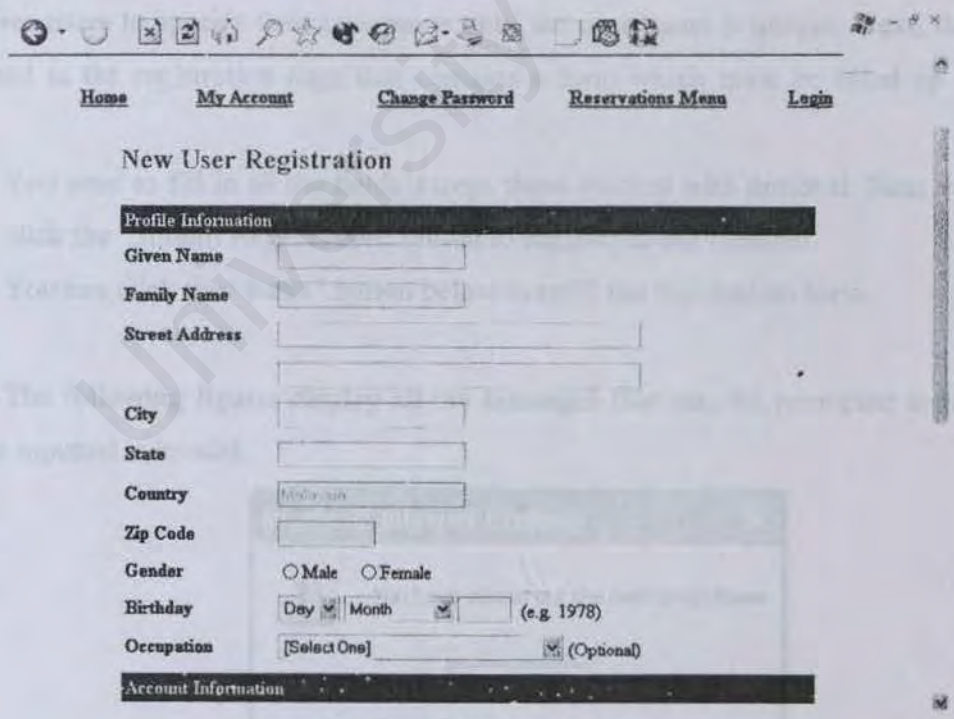


Figure 28 Part 1 of registration page.

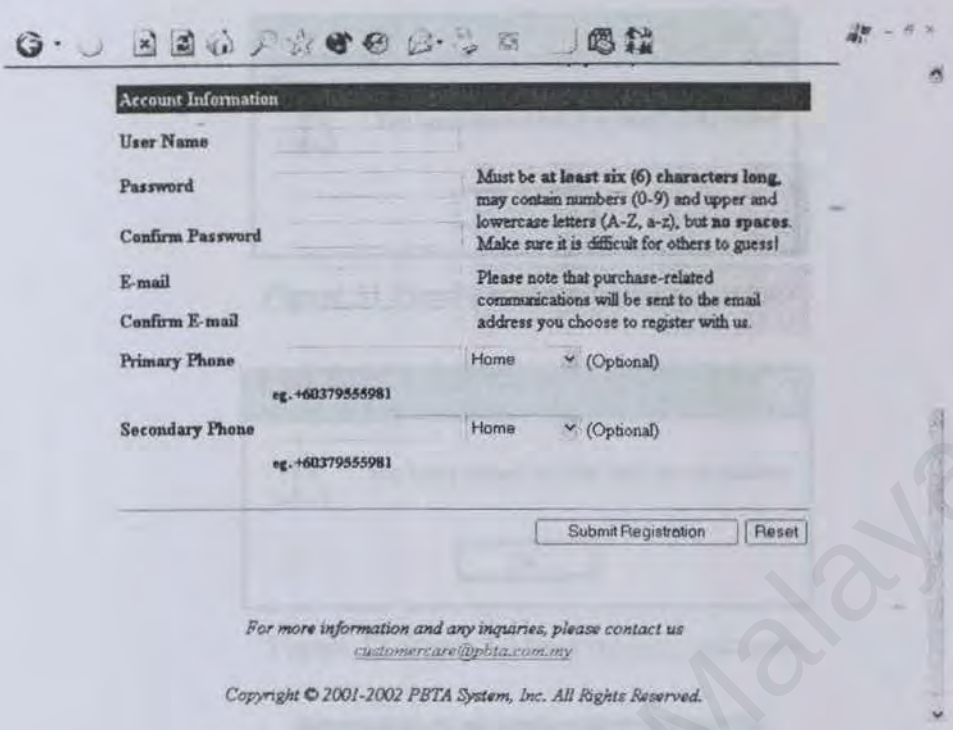


Figure 29 Part 2 of registration page.

The registration process of PBTA System is separated into two procedures. First, it requires users to specify their user name until the user name is unique. Next, they are redirected to the registration page that contains a form which must be filled up by the users.

1. You need to fill in all the fields except those marked with optional. Next you can click the "Submit Registration" button to register as our member.
2. You can click the "Reset" button below to refill the registration form.

The following figures display all the messages that may be prompted to users if the data inputted is invalid.

Figure 30 Given name missing out error.

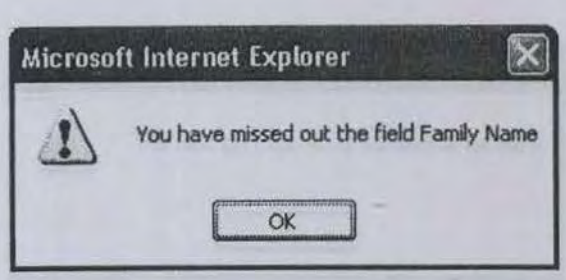


Figure 31 Family name missing out error.

Figure 32 Street Address missing out error.

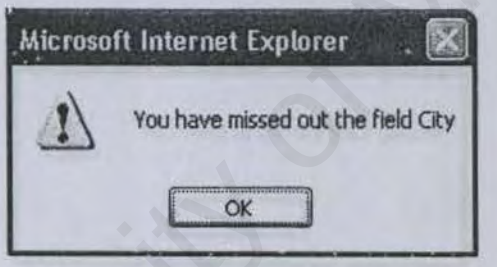


Figure 33 City missing out error.

Figure 34 State missing out error.

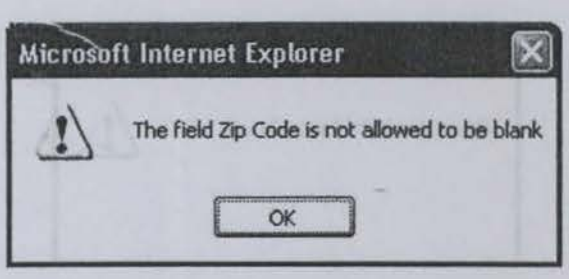


Figure 35 Zip code missing out error.

Figure 36 Invalid zip code error.

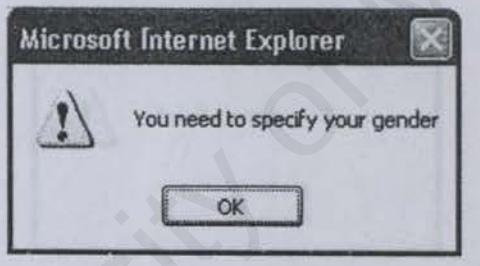


Figure 37 Gender unspecified error.

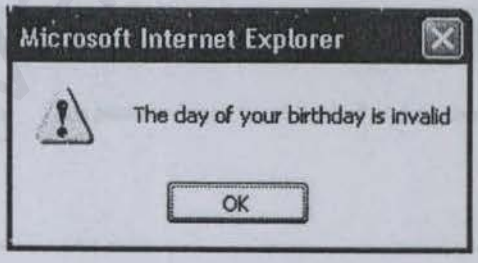


Figure 38 Invalid day error.

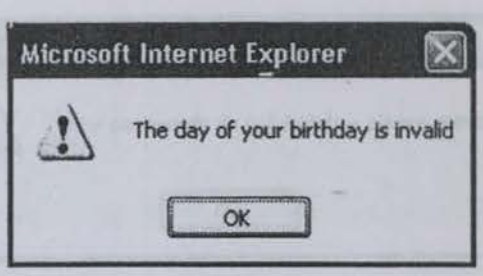


Figure 39 Invalid month error.

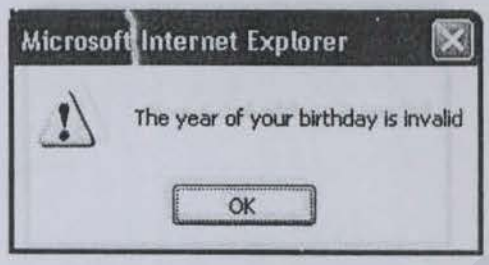


Figure 40 Invalid year error.

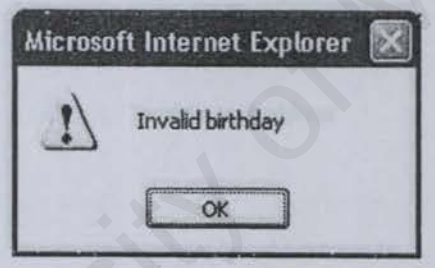


Figure 41 Invalid birthday error.

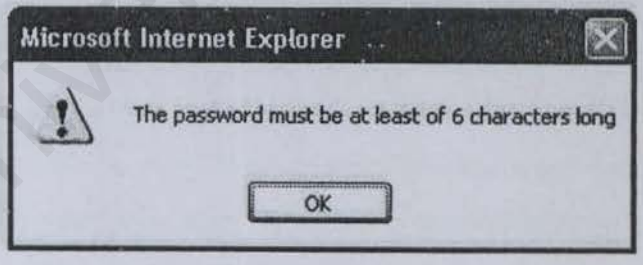


Figure 42 Invalid password error.

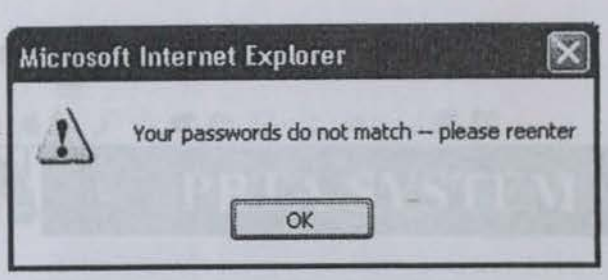


Figure 43 Password don't match error.

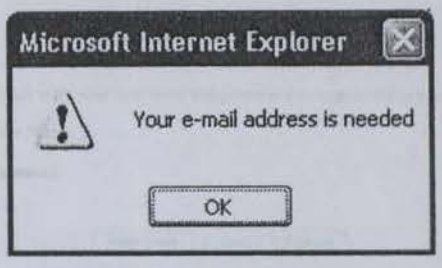


Figure 44 E-mail address missing out error.

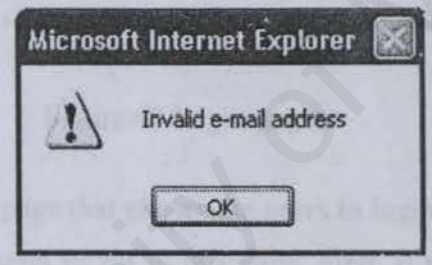


Figure 45 Invalid e-mail address error.

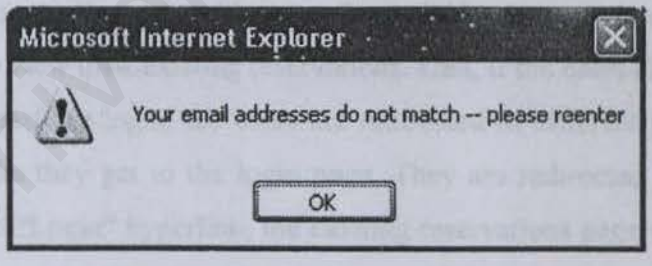


Figure 46 E-mail addresses don't match error.

2.1.9 Login page.

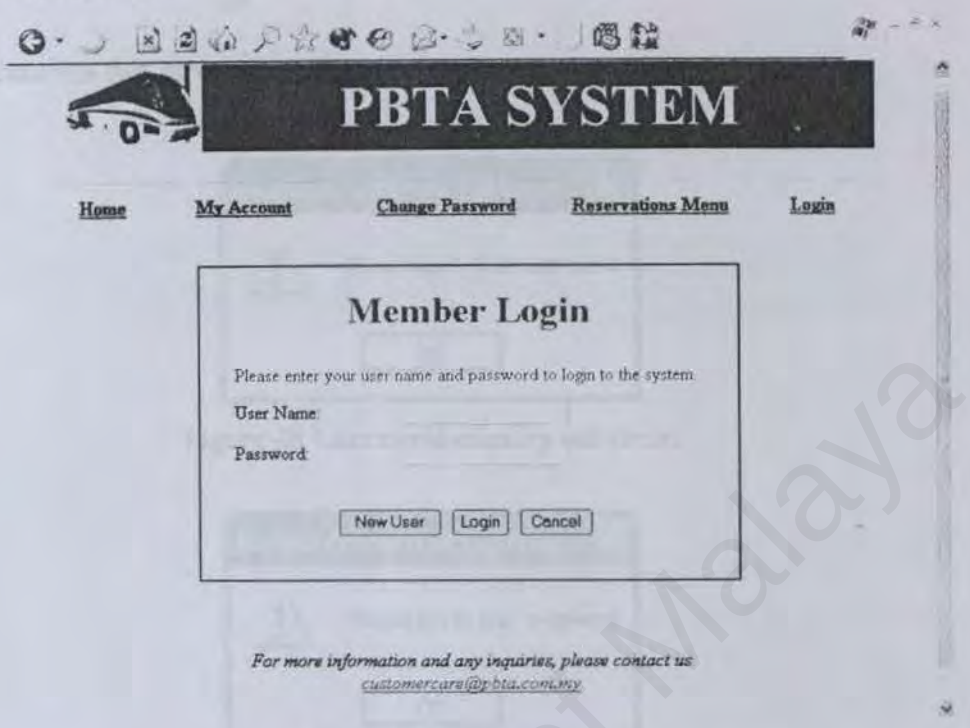


Figure 47 Login page.

Figure 47 presents the page that allows the users to login to the system. There are more than one ways for the users to get to this page. First, if the users click the "Hold This Request" button or "Proceed" button on the search result page without first login to the system, then they are redirected to this page. Second, if users want to edit their profile. Third, if users want to view their existing reservations. Last, if the users click the "Login" hyperlink. After successfully login, the users are redirected to different page depending on through which links they get to the login page. They are redirected to homepage if they login through the "Login" hyperlink, the existing reservations page when they want to view their existing reservations, profile detail page if they want to edit their profile, search result page if they want to make a hold request, and billing information page if they want to make a reservation.

1. You can key in your user name and password and then press the "Login" button to login to the system.
2. You can press the "New User" button to go to the specify user name page.

3. You can press the "Cancel" button to return to the homepage.

This page contains two error messages as below:

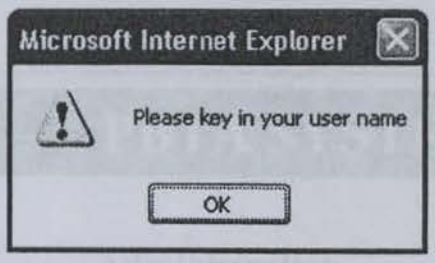


Figure 48 User name missing out error.

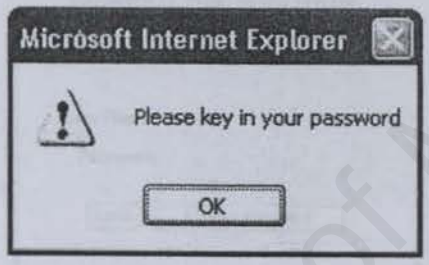


Figure 49 Password missing out error.

2.2 Administrator Module.

2.2.1 Main page of PBTA Administration.

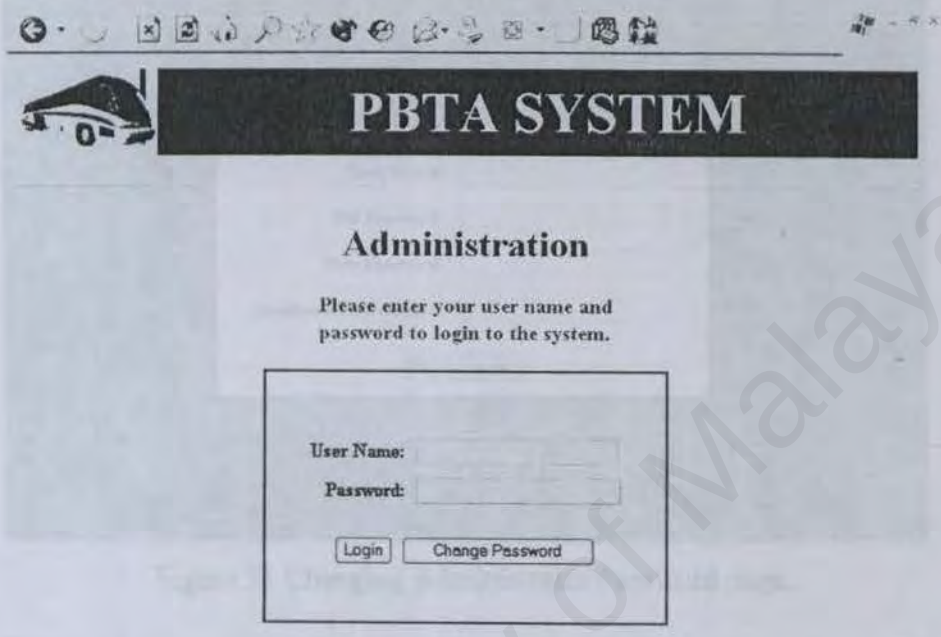


Figure 50 Main page of PBTA Administration.

Figure 50 displays the main page of Administration Module where the administrator can login to the system.

1. You can key in the user name and password, then click on the "Login" button to login to the system.
2. You can click the "Change Password" button to go to the page that allows you to change your current password.

2.2.2 Changing Administrator Password page.

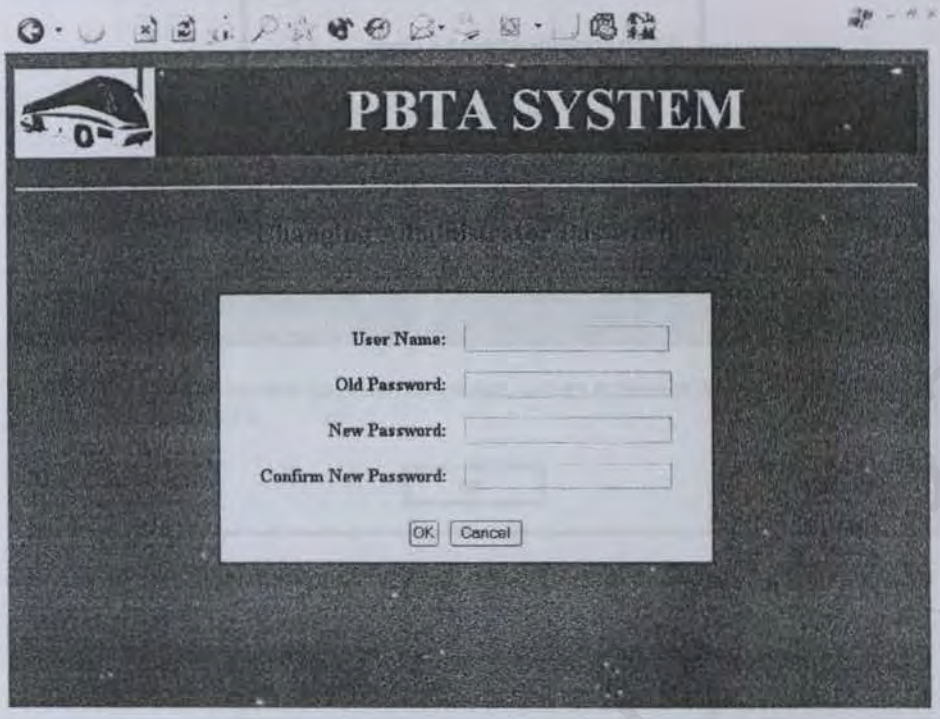


Figure 51 Changing Administrator Password page.

Figure 51 presents the page that allows the administrator to change the current password. The administrator is directed to homepage after finish change the password.

1. You can key in all the required data and click the "OK" button to change your current password.
2. You can return to the homepage without changing your password by clicking the "Cancel" button.

The following figures display the message boxes that are prompted if the errors occurred.

Figure 52 New password missing out error.

Figure 53 New passwords don't match error.

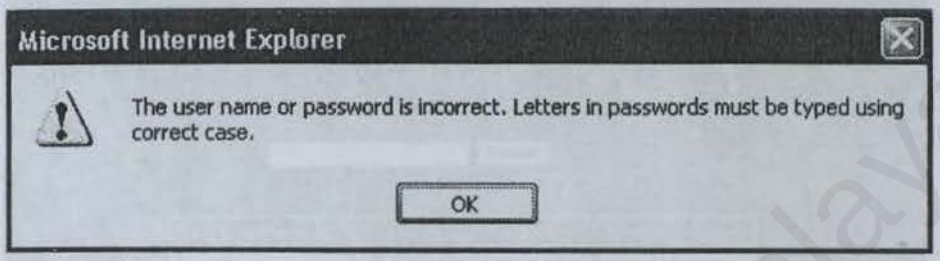


Figure 54 Changing password failed message.

Figure 55 Changing password succeeded message.

2.2.3 Member Profile Maintenance page.

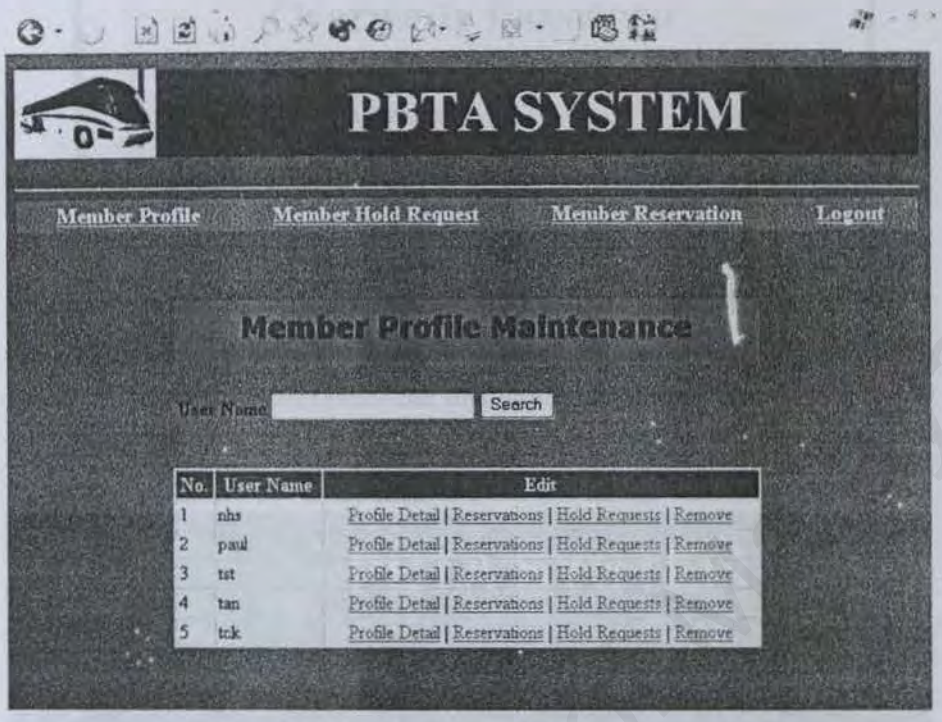


Figure 56 Member Profile Maintenance page.

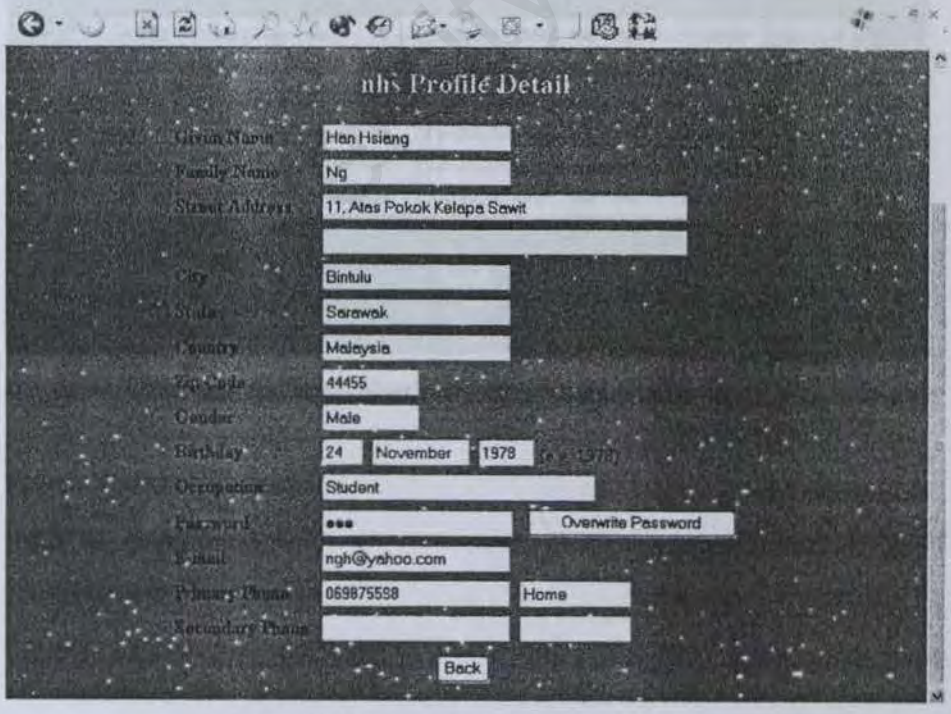


Figure 57 Details of member profile page.

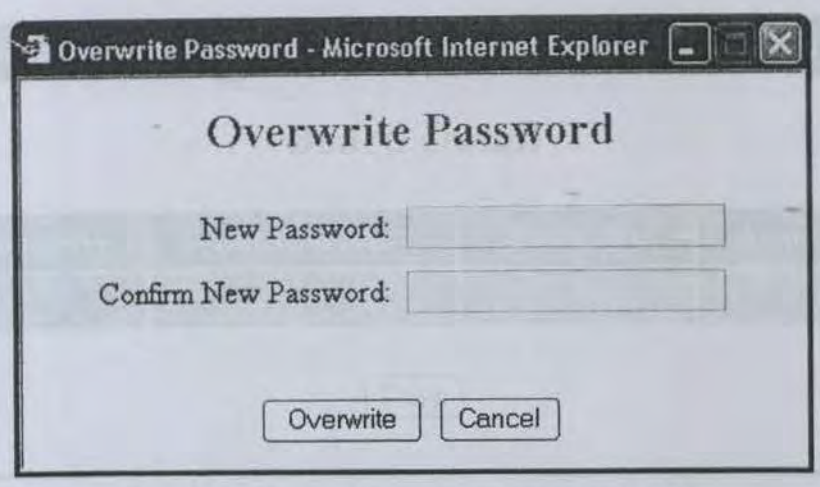


Figure 58 Overwrite member's password page.

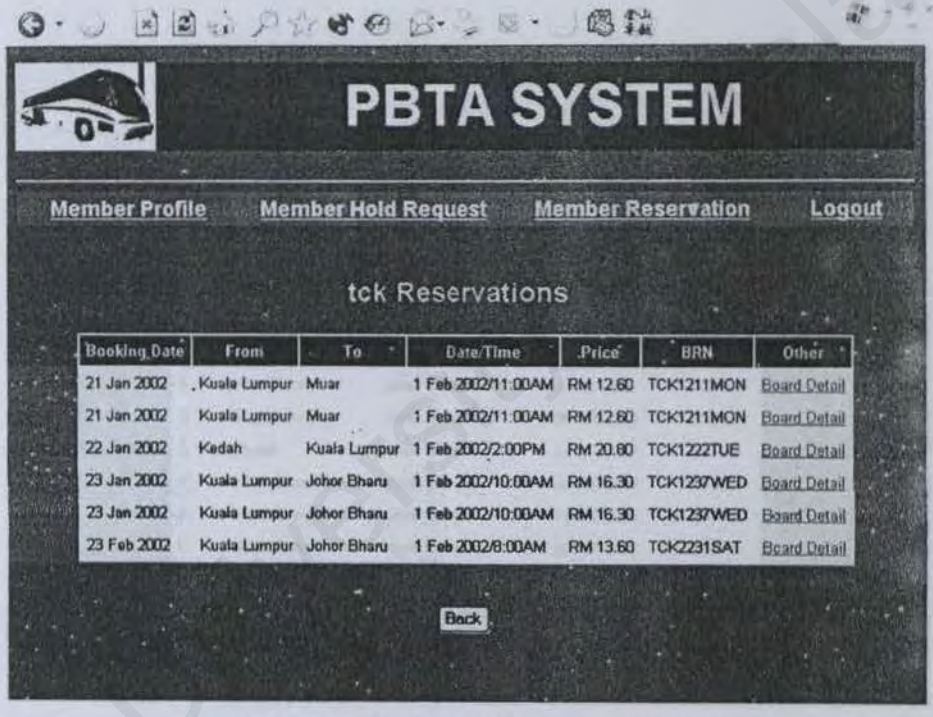


Figure 59 Member's existing reservations page.

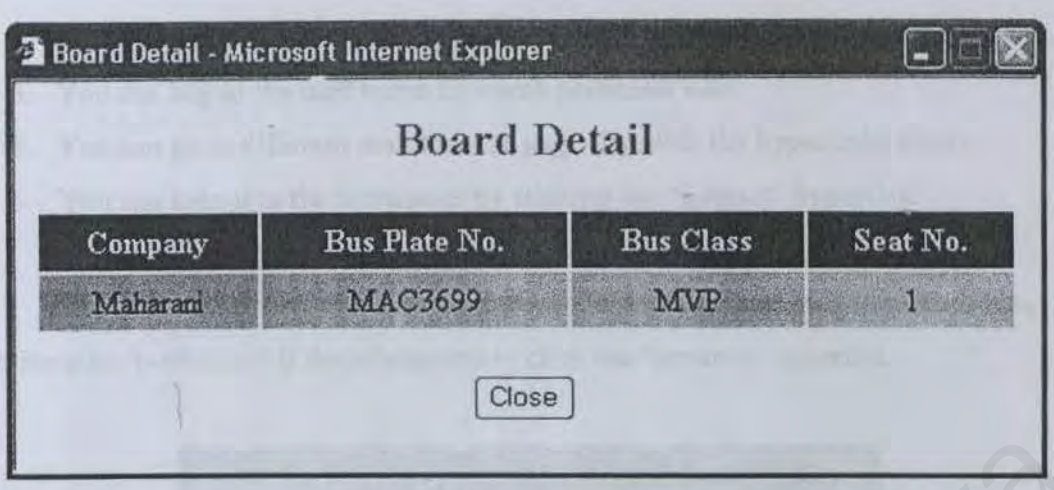


Figure 60 Board detail page.

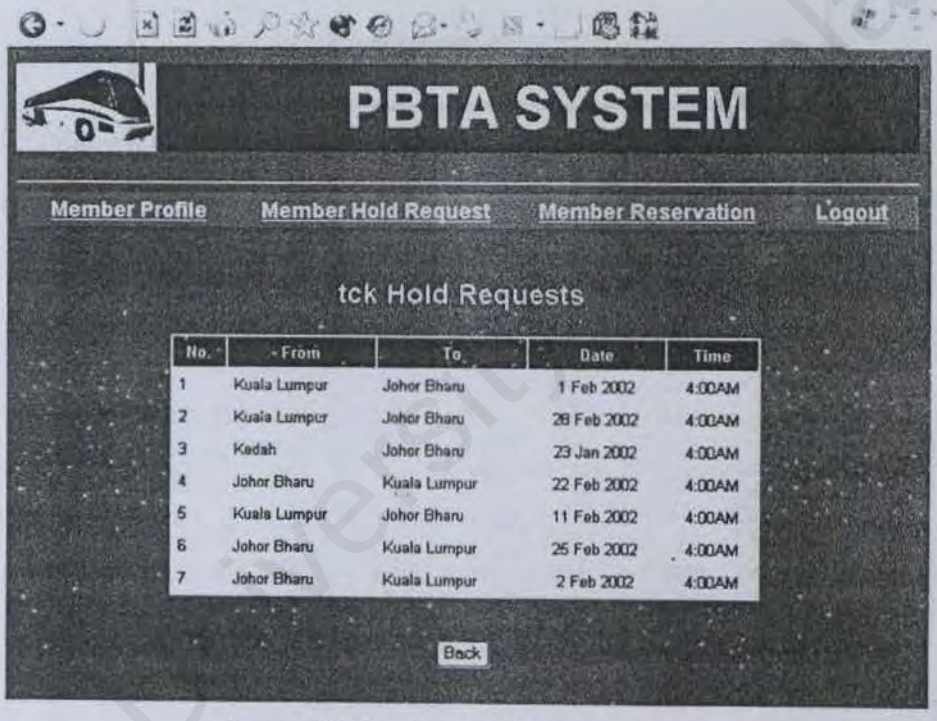


Figure 61 Member's hold requests page.

Figure 56 presents the member profile maintenance page which the administrator is directed to after successfully login. During viewing the member's profile detail, the administrator is only allowed to overwrite the member's password but other profile details are read only.

1. You can view the members' profile detail, existing reservations and hold requests by clicking the corresponding hyperlink.

2. You can click the "remove" hyperlink to remove the members from the system.
3. You can key in the user name to search particular user.
4. You can go to different maintenance pages by click the hyperlinks above.
5. You can logout to the homepage by clicking the "Logout" hyperlink.

In order to avoid the administrator accidentally remove the members, the confirmation is obtained if the administrator click the "remove" hyperlink.

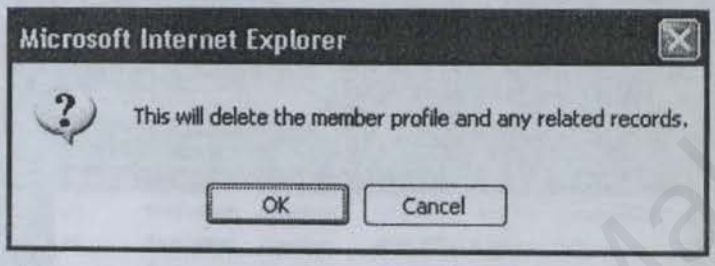


Figure 62 Confirmation box to avoid accidentally remove the member.

2.2.4 Member Hold Request Maintenance page.

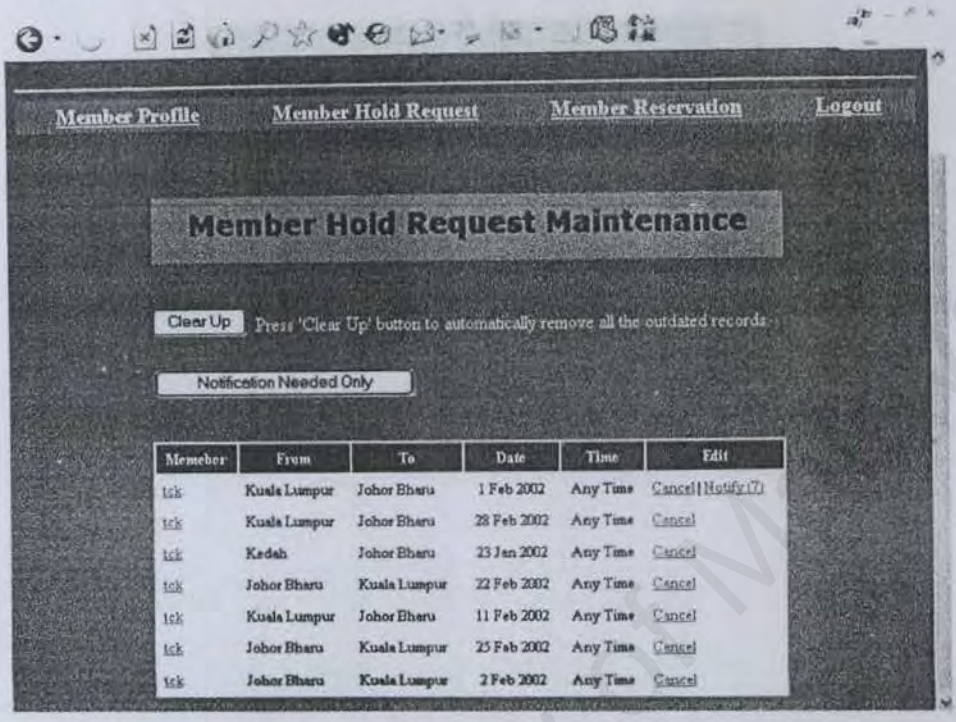


Figure 63 Member hold request maintenance page.

Figure 63 presents the member hold request maintenance page. The "Notify" hyperlink is displayed if only the tickets are available and the number shown in the brackets represents the number of tickets available.

1. You can press the "Clear Up" button to automatically delete all the outdated hold requests.
2. You can press the "Notification Needed Only" button to filter the records so as only the hold requests for the available tickets are displayed.
3. You can click the hyperlinks that displayed as the members' user names to view the members' profile detail as shown on Figure 57.
4. You can click the "Cancel" hyperlink to delete the hold request.
5. You can click the "Notify (x)" hyperlink to call the e-mail server such Microsoft Outlook to send the notification e-mail to the users.

To avoid the administrator accidentally remove any hold requests, the confirmation message is prompted if the "Cancel" hyperlink is clicked.

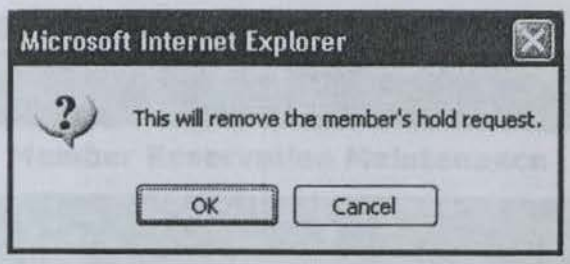


Figure 64 Confirmation box to avoid accidentally remove the hold request.

2.2.5 Member Reservation Maintenance page.

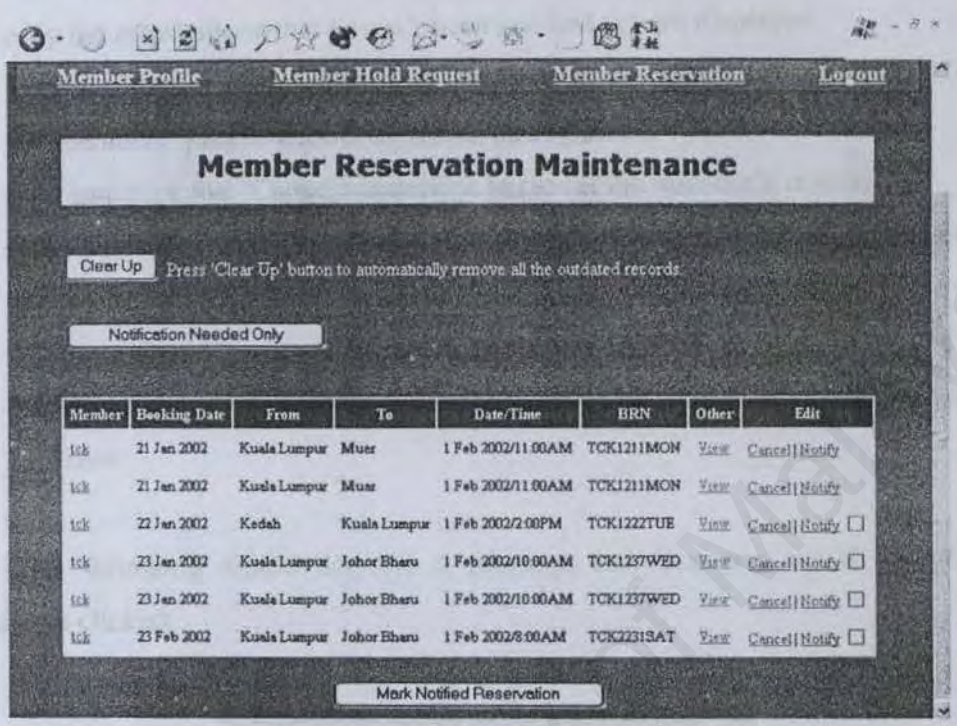


Figure 65 Member reservation maintenance page.

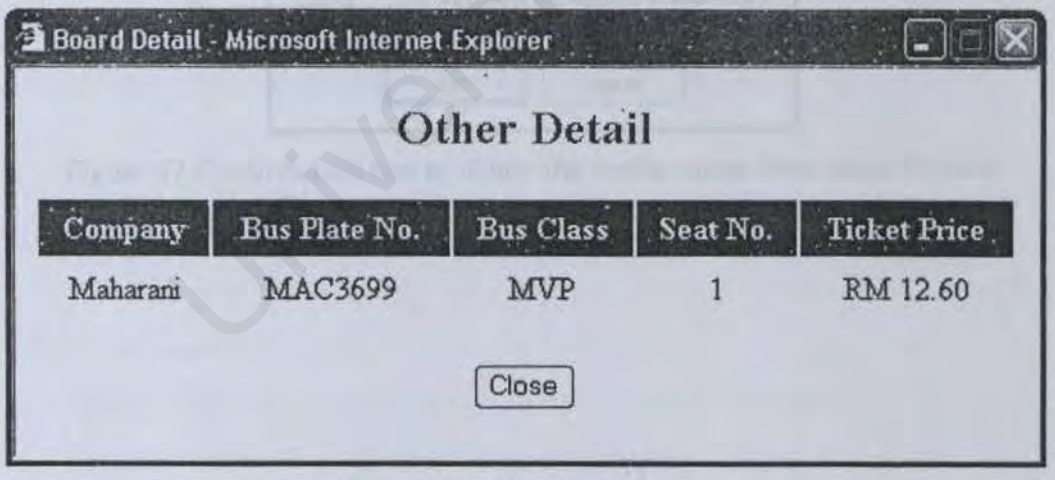


Figure 66 Other details page.

Figure 65 presents the member reservation maintenance page that allows the administrator to perform certain task about the members' reservations.

1. You can click the "Clear Up" button to automatically delete all the outdated reservations.
2. You can click the "Notification Needed Only" button to filter the records so as only the reservations that haven't been notified yet are displayed.
3. You can click the hyperlinks that appeared as the members' user names to view the members' profile details as shown on Figure 57.
4. You can click the "Cancel" hyperlink to cancel the member's reservation.
5. You can click the "Notify" hyperlink to call the e-mail server for sending the notification e-mail to the members.
6. You can check the check boxes on the right hand side and then press the "Mark Notified Reservation" button below to mark those records that have been notified just now.

The following figure displays a message box that pop up if the "Cancel" hyperlink is clicked.

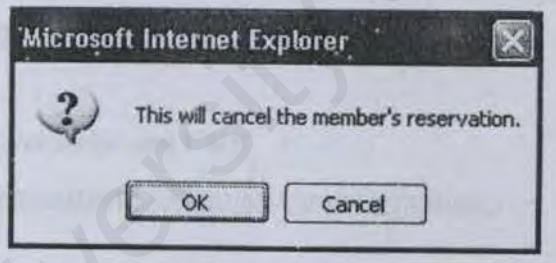


Figure 67 Confirmation box to obtain the confirmation from administrator.

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